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USSR Report

TRANSPORTATION

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MOTOR VEHICLES AND HIGHWAYS

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MOTOR VEHICLE INDUSTRY SCIENTIFIC, TECHNICAL PROGRAMS

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 10, Oct 84 pp 7-9

[Article by A. V. Butuzov, of Minavtoprom (Ministry of the Automotive Industry): "The Realization of Combined Scientific and Technical Programs Is the Most Important Tool for the Further Development of Domestic Motor Vehicle Building"]

[Text] A special feature of our country's economic, and scientific-technical development, at its present stage, is the need for enterprises and organizations of various ministries and departments to carry out a combination of efforts to develop new machines, equipment and technological processes, and to develop new economic regions and to find solutions to the other important problems of the national economy.

The specialized program planning method, having found its embodiment, in particular, in the all-union programs for solving the most critical scientific and technical problems, and later as well in combined scientific and technical programs has, over the last 10-15 years, become one of the main elements in the improvement of the system for integrated planning and control of the development of the country's scientific and technical progress, as well as an effective means for strengthening the integration of science and production. It is precisely by virtue of the aid from these integrated programs, that coordination of the activity of various ministries, departments and controlling agencies has been made available in solving major scientific and technical problems. The widespread application of integrated programs in long range planning helps in giving more complete consideration to scientific and technical achievements, and in coordinating sectorial and regional aspects of the plans more closely. In addition, the programs provide for distinct apportionment with regard to those carrying out the work, to deadlines and volumes of work, as well as to material, labor and financial resources.

As is well known, GKNT [State Committee for Science and Technology], USSR Gosplan and the USSR Academy of Sciences, working in conjunction with union republic ministries and administrative agencies have drawn up and approved 170 state scientific and technical programs for 1981-1985, among which are 41 special-purpose integrated programs, the realization of which should have an appreciable economic effect on the national economy. Motor vehicle industry enterprises and organizations are taking part in the carrying out of over 200

assignments as part of 54 state scientific and technical programs. In particular, in the area of developing new motor vehicle equipment, Minavtoprom is taking part in the realization of seven special-purpose integrated programs and 18 programs aimed at solving scientific and technical problems.

In keeping with the program assignments and the NIR [scientific research work] and OKR [experimental design work] plans which have taken shape in developing these assignments, efforts are being carried out to find solutions for such special-purpose problems as increasing the productivity of motor transport equipment, economizing labor, fuel-energy and material resources, improving the quality and extending the useful life of motor vehicle equipment, reducing the labor-intensiveness of repair and maintenance operations for this equipment, improving the safety of the designs and reducing the chances for environmental harm. As a result, in just three of the years which have gone by in the 11th Five-Year Plan period, the average load-carrying capacity for motor vehicles and truck trailer trains increased from 6.23 to 6.74 tons, and the productivity of motor transport equipment increased by 4.5 percent. Dieselization has grown at accelerated rates (the output of diesel-powered vehicles jumped 23 percent in three years).

Realization of the efforts conducted by sectorial enterprises and scientific research institutes for the development of new motor vehicles and upgrading of those already in series production is designed for the fact that in 1985 the load-carrying capacity of the truck trailer trains used for high-volume freight transport will increase from 16-20 tons to 20-25 tons, the average power for production truck engines will increase five percent, reaching 103 kW, and the specific power for truck trailer trains will increase 5.5-5.9 kW/ton. The specific fuel consumption for diesel engines is slated to decrease by 3-5 percent, and by 3-7 percent for the carburetor engines of passenger cars; the specific consumption of materials (rated per ton of specific load-carrying capacity) is to be reduced by 3-5 percent, and the labor intensiveness for maintenance work--by 15-20 percent. Increases are planned for the service life of trucks, the trailer fleet, and buses.

A task has been set for the sector for the 12th Five-Year Plan period: to bring about, up to 1990, a further significant increase in the technical level of our output, primarily in the areas of fuel economy, reliability and durability, reduction of specific metal content per unit, and harmful exhausts. Thus, the development of economical front-wheel drive passenger cars and the introduction of ZMZ and ZIL engines, developed during the current five-year plan period, and equipped with vortex motion charging, will solve the problems associated with the fuel economy of motor transport equipment. (These vehicles are 6-8 percent more economical than earlier models.) Utilization of alternative fuels, including gases, has also been considered as a solution to fuel economy problems. Production of ZIL and GAZ trucks, which operate on gas fuel, is to be increased. There are plans to increase the use of methanol as an additive to gasoline, and to use compressed natural gas for trucks.

There are also appreciable resources for reducing fuel outlays incorporated in electronic control systems for the engines' operational processes, in boosting the fuel injection pressure (in diesel engines) and the supercharger

pressure, in reducing the rotational speed of the crankshaft, and in reducing mechanical losses. The distance logged by trucks and trailer equipment prior to major overhaul will have to be greatly increased in 1990 as compared to 1985. The service life for cross-country truck trailer trains will also be extended. There are also plans to increase the service life of medium and large buses. It pays to improve reliability and to reduce the labor intensiveness of maintenance and repair work: only 10-15 percent reduces the normative outlay of spare parts by 5-14 percent and makes thousands of maintenance staff personnel available.

The process of reducing the mass of trucks and passenger cars, buses, trailers and other equipment will take its normal course, and this will permit a great quantity of fuels, lubricants and metal to be saved.

Achieving these indicators for motor vehicle effectiveness involves the widespread utilization of high-quality traditional materials, particularly low-alloy, high-strength steels as well as new progressive materials (compression molded aluminum sections, plastics, including prepregs, non-freezing polypropylenes etc.).

The quality of the items making up these units is intended to equal that of the best foreign samples (tires, friction materials, industrial rubber products, electronics etc.), as is the quality of structural materials, fuels and lubricants.

Environmental protection is also one of the goal-oriented tasks of these programs. Thus, the motor vehicles' interior noise levels will be reduced by 2-3 dB (A) and will amount to only 73-78 dB (A) for passenger cars and tourist buses, and 78-80 dB (A) for trucks and city buses. The level of toxic substances found in exhaust gases will be reduced 10-15 percent on the average.

The plan prepared by Minavtoprom for an all-union scientific and technical program provides for the development and initiation of production of new models of motor vehicle equipment of a high technical level which will improve the effectiveness and quality of transport and passenger shipments, and is calculated on the realization of the above-considered national economic goal-oriented tasks of motor vehicle equipment design development which are planned for 1986-1990 and for the period up to the year 2000.

Altogether in the period from 1986 to 1990 there are plans to assimilate dozens of new and upgraded basic motor vehicle equipment models, and to take obsolete models out of production.

The program plan makes provision for uninterrupted progress in motor vehicle technology, taking the increasing demands of the national economy into consideration, and calls for the development, during the 12th Five-Year Plan period, of designs for new generations of the basic types of motor vehicles which will be produced during the 13th and 14th Five-Year Plan periods. Specifically, there are plans to finish up designing and put vehicles of 1.5-ton load-carrying capacity into production, and to develop new generations of passenger cars,

which should incorporate the continuing developments of the front-wheel drive design concept, as well as having excellent indicators for comfort, economy and mass. (The last indicator, in particular, can be reduced by 5-10 percent compared to the models of the 12th Five-Year Plan period, and economy can be improved by no less than 12 percent, while at the same time maintaining and insuring a high degree of reliability).

The new generations of MAZ and KamAZ trucks should stand out from those now in production by virtue of their high degree of fuel economy and long service life prior to major overhaul, by their low inherent mass, the low indicators for labor intensiveness in their upkeep and repair, and their low spare parts demands. Moreover, applications should be found in prospective designs for MAZ and KaMAZ trucks for truck axles made of laminated materials, tubular axle shafts, bearings with increased load-carrying capacity which, in principle, will increase a truck's service life to 500,000 km, with a 350-400 kg reduction in its mass. Resources for fuel economy will find fuller use through reduced aerodynamically-related losses.

The above-named, as well as many other types of motor vehicle equipment provided for in the program referred to, form the basis for the various modifications and specialized transport systems which have been developed using them as a starting point, and which have been called upon to meet the needs of agriculture, various industrial sectors, construction etc., for highly efficient rolling stock.

The measures which have been planned regarding modernization and the development of new models, and the successful realization of integrated scientific and technical programs,are improving the effectiveness of domestically-produced motor vehicles within the national economy, as well as their competitiveness in the foreign market.

In the area of developing new manufacturing methods and solving the problems of economy in, and the organization of production, sectorial enterprises and organizations are taking part in an effort to fulfill over 170 assignments associated with eight goal-oriented integrated programs and 21 programs aimed at solving scientific and technical problems.

The final objective of these programs is primarily to develop the kind of manufacturing methods and equipment which will, to a decisive degree, be helpful in improving labor productivity, in increasing the economy of labor, labor and fuel-energy resources, and will raise the technical level of production and the quality of manufactured products.

Sectorial enterprises and organizations, working together with other ministries and departments, are taking part in the development and assimilation of production methods and equipment for foundry, press-forging, machining, electroplating, and other forms of production. Research is being carried out regarding the use of self-lubricating materials based on polymers and refractory metals to improve the reliability and increase the service life of dry friction assemblies which work in a vacuum, and in various gaseous atmospheres in a

wide range of temperatures. Studies are also being made with regard to manufacturing intricately-shaped parts of high-strength steels using the contact hyperplasticity effect, which increases the KIM [metal utilization factor] to 0.9-0.95, and the precision of the manufacturing process to 1st or 2nd class. The application of hard-facing to the working surfaces of engine and running gear parts for motor vehicles is also being studied.

Within the framework of the above-mentioned programs, EKTIavtoprom is carrying out finishing work at the AZLK [Moscow Motor Vehicle Works imeni Lenin Komsomol] on a high-speed method of manufacturing an anti-friction, anti-scuff phospate treatment; VAZ is developing a manufacturing plan for an automated system for designing passenger car bodies and forging-dies for parts, and a complex of equipment for automating the production of precision molds made off of burnable models is being developed at the Irbit Motorcycle Plant, with NIITavtoprom [Scientific Research Institute for Motor Vehicle Industry Technology] assistance. A domestically-produced automated production line is being set up at ZIL for forging engine crankshafts and front axle cross-members for trucks; at KamAZ a complex of automatic production lines for turning diesel engine sleeves is being equipped with an automated computer-operated control system; VAZ is starting up series production of two-armed automatic manipulators with a 1-kg lifting capacity (modular construction with pneumatic drive) etc.

Sectorial enterprises and organizations have begun, this year, to execute goal-oriented scientific and technical programs to automate production using microprocessor equipment.

In the area of manufacturing methods, provision has been made, through one of the programs, for the development of a complex system of control of flexible automated production in the ZIL Production Association, and for ASU TP [Automated Systems of Control for Production Methods] for smelting with electric arc furnaces at AvtoVAZ, for painting chambers, and for an automated system of output accounting, and for monitoring the condition of equipment at AvtoZAZ, etc.

In the decree of the CPSU Central Committee and the USSR Council of Ministers "On Measures to Accelerate Scientific and Technical Progress in the National Economy", the need was acknowledged for expanded use of the goal-program method of planning in scientific and technical development. It has been settled, that beginning with the 12th Five-Year Plan period, in addition to the all-union scientific and technical programs, republic (inter-republican), sectorial (inter-sectorial), and regional and territorial scientific and technical programs are to be developed.

Within the motor vehicle industry, there already exists experience in setting up and realizing such programs. Thus, the sectorial program "Basic Directions for Scientific and Technical Progress in the Motor Vehicle Industry for the 11th Five-Year Plan and up to the year 1990" was developed for the 11th Five-Year Plan. Work is also underway on coordinated inter-sectorial plans, and on plans for collaboration among enterprises and organizations of the sector and other ministries and departments, within which goal-program planning has been used.

The sectorial program for NTP [scientific and technical progress] takes in the area of creating new motor vehicle equipment, bearings, moped production, electric equipment for automobiles and tractors, and new materials and production methods for motor vehicle construction.

The program for scientific and technical progress in the field of the technology of basic motor vehicle industry production methods includes such directions and themes for the thrust of its efforts as provide efficiency, as much for the sector as for the national economy, as regards the main problems, which are: how to increase labor productivity (releasing workers), how to economize on material and power-production resources--electric power, fuel, metal and other materials, how to improve the quality of the output, how to satisfy ecological requirements, preserve the environment and improve working conditions.

The program for scientific and technical progress being realized during the 11th Five-Year Plan period includes efforts in the field of production technology in 22 basic directions. Several of the more important and effective themes are being developed within each of the directions. Among them are a casting process which uses core-molds manufactured for hot-forging equipment; introduction of automatic hot-forging production lines; cold extrusion; the powder metallurgy method of parts production, the production of economical small-leaf springs, introduction of programmed control metal-cutting machine tools, friction welding, laser treatment, use of new anticorrosive materials and strain-hardening coatings, introduction of industrial robots, electronic control systems etc.

The realization of themes such as the introduction of special-purpose metal-cutting machine tools and automatic machining lines, mechanization and automation of warehouses and the introduction of industrial robots will release the largest possible number of workers for other tasks.

The introduction of automatic thermochemical treatment lines and automatic and mechanized welding lines will effect an appreciable saving of electric power.

A considerable saving in ferrous metals will be effected through the realization of the planned production volumes of blanks and parts by the cold heading and cold extrusion processes and casting into molds manufactured by progressive sealing methods on automatic molding lines.

A major national economic effect, (by increasing the quality and extending the service life 1.5-2-fold), will be obtained as a result of mastering ion-vacuum processes for coating motor vehicle parts, and the use of new anticorrosive materials--plastisols--for protection of the bottom sections of vehicle bodies.

An example of an integrated solution to ecological problems is the practice of regeneration of spent molding and core sands in foundries: it allows the silica sand to be saved, arable and farm lands to be preserved by reducing the area needed for dumps as well as freeing motor vehicle transport and saving

fuel thanks to the reduced volume of wastes hauled to the dumps. Air quality has been improved by the introduction of induction heating for the stamping process, one result of which is a reduction in the discharge of harmful gases. This has been radically reduced thanks to the use of new anticorrosive materials such as plastisols, and means by which paint vapors are used.

The program for scientific and technical progress in motor vehicle industry technology determines, on the whole, the development of its basic modes of production, i.e., foundry work, hot processes, stamping, machining etc. In the course of this program's realization, in the years 1981-1983 alone, the production of castings of high-strength cast iron increased 2.4-fold. GAZ, KamAZ, UralAZ, and the Ulyanovsk Motor Vehicle Works imeni V. I. Lenin have begun production of a high-strength machine-tool manufacturing casting from Mikhenayt cast iron. Reduced-shrinkage hot forgings produced on hot-forging crank presses has increased 3.8-fold; stampings produced by cross-helical rolling, cross-wedge and longitudinal rolling have increased 2.4-fold, and the volume of parts produced by powder metallurgy has increased 1.3-fold.

Heat treatment shops and sections have begun to be equipped with indestructible instruments for monitoring the quality control of parts.

Highly-efficient high-speed power grinding processes have been assimilated in a number of the sector's plants, including the Iaroslavl Engine Works, GAZ, VAZ, Soyuzavtoagregat [All-Union Industrial Association for Motor Vehicle Units and Parts Production] plants etc.

The Belorussian Motor Vehicle Works has organized special-purpose production for hardening the less-durable parts of open-pit mining dump trucks, and has increased their durability more than 2-fold, and has extended their run life from 60,000-80,000 km to 150,000 km.

The AZLK has set up a section for metal-plating the large drawing dies used in forming body parts, and this has reduced the quantity of defective dies, and eliminated the need to manufacture large-form doubles. This expedient has saved 500 tons of steel plate.

In an effort to continue developing the domestic motor vehicle building industry more actively, sectorial enterprises and organizations, based on accumulated experience, are developing a sectorial program for scientific and technical progress to span the years 1986-1990. They plan to carry out, within this program, an extensive combination of efforts which will take in all basic modes of production. In addition to making use of progressive production processes which have already been mastered during the 11th Five-Year Plan period, they plan, during the 12th Five-Year Plan period, to develop and introduce new processes and equipment, to set up versatile automated production operations, automated planning systems, robot-equipped complexes etc.

The 12th Five-Year Plan period's program provides for renewal of the metal-cutting and press-forging equipment inventory; for an increase in the shift-work factor for machine tools and production lines, and especially for machine tools with numerical program control, for special-purpose equipment, flexible

modules and production complexes. The program calls for an in-depth modernization of many thousands of units of metalworking equipment, which also means by equipping machine tools with robot controls, numerical program control, digital indicators, master controllers and other special-purpose devices; for many thousands of versatile production modules and versatile automated complexes to be put into operation, as well as thousands of improved robots.

In addition, the program makes provision for the development of sample-indicating versatile automated systems at at AZLK, ZIL and GPZ-11; for full automation of non-ferrous metal casting processes using robot equipment complexes at the UralAZ Production Association plants, and AvtoZAZ and AvtoUAZ plants; widespread dissemination of new production processes, including powder metallurgy, hardening coatings, electronic and laser treatment, friction welding etc.; automation of on- and off-loading, transport, planning and engineering operations, and other measures.

Realization of the program for scientific and technical progress during the 12th Five-Year Plan period will permit the sectors to insure production of the motor vehicle equipment needed by the national economy, with a concomitant improvement in production efficiency, which includes increases in labor productivity and reduction of the prime cost for output.

By and large, using the integrated goal-program method is the most effective and efficient means for continuing the development of the motor vehicle industry and for realizing the most important national economic tasks facing the sector.

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MOTOR VEHICLES AND HIGHWAYS

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MOTOR VEHICLE ALTERNATIVE FUELS RESEARCH IN USSR

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 12, Dec 84 pp 30-32

[Article by Candidate of Technical Sciences Ye. V. Shatrov, of NAMI (Central Motor Vehicle and Engine Scientific Research Institute): "Operation of Motor Vehicles on Alternative Fuels. Status and Prospects for Development", under the rubric "Preserving the Environment and Economizing Fuel-Energy Resources"]

[Text] The uninterrupted growth of the nation's motor vehicle fleet, of the volume of freight shipments and of fuel consumption has brought the problem of rational utilization and expansion of motor vehicle fuel resources to the fore as one of our most important issues. In a search for a solution, sectorial scientific research institutes and plants, making use of previously accumulated experience, and of results of scientific research, have, in the first four years of this as yet uncompleted 11th Five-Year Plan period, introduced a number of new and promising developments.

Thus, VAZ [Order of Labor Red Banner Volga Motor Vehicle Works imeni 50-letiye USSR] started up production in 1984, (as a complete program), of engines with the vortex motion charge feature, which effects a 5 percent reduction in operating outlays for fuel for trucks and buses. Work has been completed on devising vortex motion charge engines for motor vehicles of the ZIL line. Fuel consumption for motor vehicles equipped with these new engines will drop by 6-8 percent. VAZ motor vehicles are being equipped with Ozon carburetors, which will reduce fuel consumption for these vehicles by 5-6 percent. The carburetors on UAZ and ZAZ vehicles have been modernized, reducing fuel consumption by 3-4 percent. Production has begun on passenger cars, the operating fuel costs for which are 5-10 percent lower than for previous models. Preparations are being made for production of ZIL, GAZ, Ural and VAZ diesel engines, which will provide the vehicles with fuel consumption rates which are 25-30 percent lower than for gasoline engines. As a result of having realized a number of measures to reduce fuel consumption, which measures were associated with improving the operation of the engines and their fuel system equipment, and with reducing mechanical losses, the Specifications were reviewed in 1983, and the specific fuel consumption rates were lowered.

All of these will provide (and are already providing) quite an appreciable saving in petroleum fuels. However, the problem of further reducing this consumption has not yet been fully resolved, especially as the consumption of

petroleum derivatives is bound to increase, not only for motor transport, but in other sectors of the national economy as well. A conclusion suggests itself: a fundamental solution to this problem is possible only through conversion of a considerable percentage of our motor vehicles to alternate fuels operation.

One of the most valuable alternatives for motor fuels, as is commonly known, is condensed hydrocarbon (propane-butane) gas. Operational experience has shown than a motor vehicle operating on this gas displays practically no lowering of its technical-economic and operational indicators: distance endurance and payload remain exactly the same as for gasoline operation. But one important advantage which emerges is that the vehicle's sanitation and hygiene-related indicators are improved (see Table). This is the reason why the ZIL and GAZ trucks, the LiAZ and LAZ buses, and passenger car-taxis, all of which operate on condensed gas, and which were displayed at the Avtoprom-84 exhibition, are now in series production.

Type of Fuel	Fuel Storage System		Fuel Mass, kg	Fuel Distance Endurance	Ne, kW	CO Discharge, %	Gasoline Saved, %
	Mass, kg	Maximum Tank Pressure					
Gasoline	50	0.03 MPa	120	400	100	100	--
Liquid Hydrocarbon Gas	150	1.6 "	120	400	103	35	100
Compressed Methane	500	20 "	60	250	88-92	35	100
Liquid Methane	80	0.3 "	75	350	88-92	35	100
Gasoline + MTBE (8-10%)	50	0.08 "	120	400	110	--	--
Benzometharol mixtures:							
BM5	50	0.03 "	120	388	110	97-95	2.5
BM15	50	0.03 "	120	360	110	97-95	14
Methanol (M100)	100	0.03 "	250	400	115	90	100

In 1982 the sector set up series production of motor vehicles (which were also displayed at the exhibition) which run on compressed natural gas (methane), as well as production of sets of fuel-feed equipment for converting vehicles which are presently in operation over to this fuel. The operational indicators for motor vehicles operating on compressed methane are somewhat lower than for operation on liquefied hydrocarbon gas. Thus, the fuel distance endurance for a ZIL-130 is reduced by 38 percent, and the load-carrying capacity by 500-550 kg: the mass of the container used to store compressed gas at a pressure of 20 MPa is 500 kg more than the mass of a gasoline tank, and 400 kg more than a container for liquified hydrocarbon gas. Therefore, NAMI and plant specialists

need to greatly reduce the mass of the natural gas storage system. There are commonly known methods for doing this: by storing the natural gas aboard the vehicle in liquid form; by using gas cylinders made of high-strength composite materials, the mass of which is half that of gas cylinders made of alloyed steel; and by improving the fuel-feed equipment. And these methods have been achieved. Specifically, a new design has been worked out for a three-step pressure regulator-preheater, the size and mass of which are considerably less than those of the equipment now in series-production. This new regulator has been standardized for all truck, passenger car and bus models which run on compressed natural gas or liquified hydrocarbon gas. Efforts are underway to develop small-mass metal-based laminate tanks and cryogenic systems for storing liquid methane aboard motor vehicles. (There are indisputable advantages in using liquid methane: it has been made easily transportable; it makes the vehicle independent of the filling station network; it requires a container of 6-fold less mass than would be needed for compressed gas; it gives the vehicle the very same fuel distance endurance and payload available from gasoline.) As an example of such a system, let us consider the system developed by the UkSSR Academy of Sciences' Physicotechnical Institute of Low Temperatures, and installed in ZIL-138A and GAZ-53-27 motor vehicles by NAMI. It consists of a special 180-liter tank and an automatic system for controlling the supply of fuel to the engine, and gives the vehicle a 350-km fuel distance endurance. The system has a mass of 80 kg, and its power supply derives from instruments installed in the series-produced modified version of the vehicle, which runs on compressed natural gas. Further, the vehicle has also been equipped with a methane evaporator and preheater, which uses the heat from spent gases and from the engine's cooling system liquid. The cryogenic tank has vacuum screen thermal insulation, and its interior and exterior housing are of aluminum alloy. The tank is equipped with a system which automatically maintains desired pressure,and consists of a pressurization circuit (the pressure is increased as a result of evaporating part of the gas's liquid phase), and a switching device which feeds the gaseous methane phase into the engine's fuel supply unit and reduces the pressure in the tank to the prescribed level. Furthermore, the tank is equipped with gas pressure-relief valves, a refueling device, and instruments for remote measurement of the gas and pressure levels. Work is also underway on a 100-liter system of cryogenic equipment for the UAZ-451 motor vehicle.

Cryogenic storages systems for liquid methane, fuel-feed devices and automatic control systems are now at the stage of final operational development, and plans are for the first consignment of motor vehicles equipped with these systems to be turned over in 1985 for a wide range of operational tests.

The engines on motor vehicles equipped with gas cylinders have double (gas-gasoline) fuel-feed systems, and a compression ratio suitable to operate these engines on A-76 gasoline. These relatively low compression ratios do not permit gas to be used to its full potential as a motor vehicle fuel, but are justifiable at present, as they provide the gas cylinder equipment with uninterrupted transport operation, even when the vehicles are driven out of areas where filling stations operate. A good time to install engines with the special gas modification and higher compression ratios on gas-cylinder-

equipped motor vehicles, especially those vehicles designed for use within a short operational radius, would be at the same time the number of gas-filling stations undergoes an increase. Efforts are already underway in sectorial plants as well as scientific research institutes to determine the optimal compression ratio for natural gas-powered engines.

After gas, methanol could serve as the most likely substitute for petroleum-based motor vehicle fuel. Motor vehicle transport equipment can operate normally with this additive in the gasoline; for example, introduction of 3-5 percent leaves an engine's characteristics of power, economy and toxicity practically unchanged (see Table), and it is used in series-produced motor vehicles with no change made in the engine designs or in the regulation of their fuel-feed systems, or their combustion in all of the country's climatic zones (when ambient air temperatures are above freezing).

Fuel feed systems have also been developed for truck and passenger car engines, which systems operate on a mixture of gasoline with 15 percent methanol and 7 percent isobutyl alcohol (a stabilizer) with minimal changes in the design of the fuel-feed system elements. Engine operation on these mixtures reduces gasoline consumption by 10-14 percent, and the operational reliability and the toxicological properties of the motor vehicles is kept at the same level as that for gasoline.

True, the starting qualities of engines operating on the M-15 mixture in negative ambient air temperatures are somewhat worsened, but the stability of this mixture is completely satisfactory. In this connection, it is advisable to use this mixture primarily in the country's southern regions and in the central climatic zone.

At present, mixtures with a 15 percent methanol and 7 percent isobutyl alcohol content are undergoing operational checking.

Based on the results of experimental research done on engines operating on gasoline-methanol mixtures, as well as on calculations and theoretical data gathered in the area of alternative fuels combustion, NAMI has been working on the development of motor vehicles, the engines of which operate on pure methanol. And prototypes of these motor vehicles and engines (the ZIL-130 and GAZ-53) are undergoing tests. Already, the initial results have shown that the power of an engine operating on pure methanol is 6-7 percent higher, and that the overall toxicity is 30 percent lower than for gasoline operation. However, methanol noticeably impairs an engine's starting qualities. (Methanol also has substantial heat of vaporization, and for this reason the mixture charge is supercooled, which increases the degree of nonuniformity of the mixture's distribution throughout the cylinders, and brings about a concomitant impairment of the engine's economic and toxic characteristics. Furthermore, methanol possesses less calorific power, and therefore its consumption rate is more than 2-fold higher than gasoline, and it corrodes certain of the materials used in the fuel-feed system.)

Efforts to eliminate the shortcomings inherent in methanol are continuing: intake manifoldswith an intensive preheating feature are being developed, this heat derived from exhaust gas heat or from electrical energy; spark plugs are matched to ignition timing, and corrosion-resistant materials are being developed for fuel feed system parts.

Use of MTBE [methyltributyl ether] as a gasoline additive is extremely promising. The high (up to 115 units) octane rating of this additive allows it to be used as an anti-knock additive instead of tetraethyl lead, which is toxic. Along with eliminating the discharge of lead oxides with the exhaust gases, the use of MTBE expands the possibilities for using exhaust gas neutralizing systems on motor vehicles.

Hydrogen is another motor fuel which looks promising for motor transport. In the last decade, work on hydrogen use has been done here in our country as well as abroad. Initially, the special features which took place during carburetion and combustion of hydrogen fuel were studied; the best ratios for the components of the gasoline-hydrogen mixture (gasoline--hydrogen--air) were chosen. Then designs were worked out for fuel-feed devices which would insure the most favorable combination of power-, economy- and toxicity-related characteristics for the engine; economically justifiable systems for storing hydrogen aboard the vehicle were developed (one of which was demonstrated at the exhibition), as were systems for automatically metering the hydrogen as it is fed from the storage container to the engine. Finally, bench and road tests were conducted. All these made it possible to draw a number of practical conclusions. In particular, analysis of the bench test results from an engine running on hydrogen-gasoline mixtures showed that in order to obtain the best power, economy and ecological indicators, each speed and load level had to have its own strictly specified gasoline-hydrogen-air ratio. That is why the previously suggested method of feeding the engine with gasoline accompanied by a steady addition of 5 or 10 percent hydrogen at all speeds and load levels turned out to be erroneous, since it did not provide the best fuel consumption (of gasoline and hydrogen), the optimal allowable toxicity in the spent gases, optimal engine power or vehicle performance. Using these conclusions as a basis, the NAMI specialists proposed a combined method of power regulation, by which the engine would run on pure hydrogen when idling, and with small loads, and as the load increases, the engine runs with an ever-increasing addition of gasoline, until it is running, at full load, on a gasoline-air mixture. Tests showed that the method which was chosen for regulating the engine's power provided the vehicle with the prescribed power and performance indicators at a 2-fold reduction in fuel consumption. And here, there is even a saving in gas in intensive city driving. And the fact that an ecological problem has found a radical solution in this vehicle is no less important. This has been made possible thanks to a new carburetor design, which is based on the K-126 series-produced two-barrel carburetor, but equipped with an additional (third) throat.

Thus, the advantages of hydrogen as an alternative fuel can be considered theoretically and experimentally proven. However, an on-board power-consuming storage system is needed for hydrogen to be introduced. Moreover, hydrogen is still costly.

Both of these problems are gradually being solved. Thus, even today one can use gas cylinders pressurized with up to 20 MPa of hydrogen: an installation of three of these tanks (alloyed steel with a total mass of 190-200 kg) gives the RAF microbus a fuel distance endurance of up to 300 km. Scientific research work is also underway to develop metallohydride and cryogenic hydrogen storage systems and improved-design hydride tanks, as well as to develop briquetted materials and materials which are non-dispersible during hydrogenation or dehydrogenation of the hydride materials. Research is underway to find ways to improve the reliability and safety in the metallohydride systems, which research is directed at development of ilmenite hydrides. The first prototypes of cryogenic tanks for liquid hydrogen storage have been developed and manufactured. Tests have been conducted on an engine running on the products of methanol breakdown--hydrogen and carbon monoxide--which have indicated that a vehicle's fuel distance endurance should be increased by 40-50 percent (at the identical fuel consumption achieved on pure methanol). This increase in the fuel distance endurance is the result of the fuel efficiency of the mixture: if the calorific value of pure methanol is 4,600 kilocalories/kg, then that of the products of methanol breakdown is 5,600 kilocalories/kg, i.e., 22 percent higher. Moreover, it is well to bear in mind that hydrogen is an extremely active fuel, and for this reason mixing it with carbon monoxide gives it, in comparison with liquid methanol, a higher degree of completeness of combustion, an expanded explosive range and allows the engine to operate on lean mixtures ($\alpha = 2 \div 3$). The experimental data which were obtained on the motor test bench showed that the toxicity of the exhaust gases was drastically reduced for an engine running on the products of methanol breakdown, especially under partial load and when idling (at $\alpha = 2 \div 3$ there were hardly any ascertainable toxic components in the exhaust gases).

From everything that has been said above, it follows that our domestic motor vehicle science and practice has arrived at the 60th anniversary of Soviet motor vehicle building with great successes in the field of alternative fuels, and has been able to solve a number of critically important problems. The reserve of knowledge which has thus been created will help in achieving new successes in completing the tasks of the USSR Power-Production Program.

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MOTOR VEHICLES AND HIGHWAYS

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INSTITUTE DEVELOPING TECHNOLOGY FOR MOTOR VEHICLE INDUSTRY

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 11, Nov 84 pp 29-30

[Article by Candidate of Technical Sciences S. V. Podsoblyayev, of NIITavtoprom (Scientific Research Institute of Automotive Industry Technology): "The Introduction of Progressive Technology--the Most Important Method of Improving the Effectiveness of Production"]

[Text] The "Basic Directions for the Economic and Social Development of the USSR for 1981-1985 and the period up to 1990" called for increased effectiveness by increasing labor's supply of equipment through widespread introduction of comprehensive automation and mechanization in production, by the unswerving reduction of the number of manual laborers in all sectors, especially in auxiliary and subsidiary work, and through economy of labor, materials and fuel-energy resources.

This direction acquires particular importance when viewed in the light of the decisions of the 26th CPSU Congress and successive CPSU Central Committee plenums on the changeover of the country's economy to an intensive regime of development based on the accelerated introduction into the productive sector of the achievements of scientific and technical progress and the development of new progressive forms of machinery, manufacturing methods, and equipment.

It is well known that every ruble invested to develop science, and in the assimilation of the results achieved by science into industrial production effects about 1.5 rubles of increase in national income, which is approximately 4-fold greater than the revenue brought in by the assets invested in fixed productive capital. This is exactly the reason why, in the resolutions of the 26th CPSU Congress, there are instructions to strengthen the role of science in improving efficiency in production, the result of which should be widespread use of light-operation, low-waste and no-waste production processes which use the newest high-efficiency methods of metal working, including electrochemical, plasma, laser, etc., and widespread use of industrial robots and automatic control systems which use microprocessors and other minicomputers.

The role for scientific and technical potential is also great in the automotive industry. The sector's productivity and the degree of economy of its output have an active influence on productive effectiveness in the client sectors. The technical level of production, and of manufacturing procedures and equipment determines, in large part, the rationality of the expenditures of those huge labor, material and power engineering resources which are used within the sector. And a sizeable portion of the saving of these resources has been achieved, in the final analysis, by means of progressive production processes.

In this connection, the task for NIITavtoprom, as the motor vehicle industry's main technological institute, consists in concentrating its available scientific and technical potential in an effort to achieve the most important objective, which is the economical expenditure of all resources. This will be done, in the first place, by increasing our real labor productivity through developing and introducing the most progressive and highly productive automated equipment, thus freeing labor resources, and in the second place, through the rational use of metal and other material and power engineering resources by using low-waste and less energy-consumptive production processes and, finally, by improving the quality and reliability of output by developing and introducing progressive manufacturing processes and hardening equipment, as well as in-process gauging equipment.

On the basis of these directions, NIITavtoprom, along with sectoral institutes and plants, has worked out a special-purpose comprehensive program for scientific and technical progress in the motor vehicle industry for the years 1981-1985 and up to 1990 in the area of production methods. This program has been structured according to a special purpose principle, and its primary goals are to economize labor, material and power resources within the sector and the national economy, and to improve the quality and reliability of automotive technology.

These are the same goals which are determining the structure of the institute's plan, the essence of which includes the development of equipment with which to automate and mechanize the production processes. This development is based on the implementation of modern electronic means of equipment control, numerically-controlled machine tools, robots, and microprocessing equipment. Provision has been made for the development and introduction of manufacturing processes which will conserve metal and power, and processes and equipment which will strengthen, and give longer service life to the parts and assemblies which are part of automotive technology.

A great many of these developments have been carried out having applications to projects which are part of programs of state-wide concern, such as the USSR Food Program, and the program to dieselize large-tonnage ZIL and GAZ heavy-duty trucks.

The purposeful direction of NIITavtoprom is reflected in its classified plan. Thus, in the area of automating the production processes, the plan calls for setting up automatic production lines and automated, highly productive equipment. Production forms and records are to be completely drawn up for a complex of automotive production lines to machine UralAZ vehicle wheel hubs and brake drums, an automatic line for machining bicycle crank arms for the Kharkov Bicycle Plant imeni G. I. Petrovskiy, and an automatic production line for manufacturing brake cylinder springs for the Grodnensky Automotive Assemblies Plant. Provision has been made for development of a versatile production complex of molding equipment, which includes diagnostic equipment with an ASUTP [Automated Production Process Control System], and which is primarily for the use of the Tsentrolit Foundry imeni 50-letiye VLKSM [All-Union Komsomol], in Saran. In collaboration with ZIL, KamAZ and VAZ, development is slated for an automatic flask-free [bezopochnyy] line with a vertical joint for production of large-size castings. In 1983, the institute set up a versatile production complex comprised of machine tools equipped with numerical program control and computer control for machining operations. The complex was started up this year, 1984, and a determination has been made of its technical potential and its technical and economic indicators for possible duplication within the sector. There were topics which were also made part of the plan, which provided for the setting up and implementation of automated production lines and equipment for the assembly and welding of motor vehicle, tractor and combine wheels, as well as for the assembly and welding of drive axles for MAZ and ZIL automobiles. There are plans to introduce, at the Yaroslavl Diesel Equipment Plant, an automated equipment complex for welding and testing high-pressure fuel pumps for the KamAZ engine, and plans to develop in collaboration with MKTEIavtoprom, automation equipment devices and final-assembly lines for the new MeMZ-245 engine.

To see that NIITavtoprom's efforts receive widespread dissemination, Minstankoprom [Ministry of the Machine Tool and Tool Building Industry] and in-house machine tool building enterprises have started up series production of automatic production lines and equipment for precision casting, using meltable and burnable models, automated stack molding equipment, equipment for casting low-compression aluminum cylinder heads, machines for stamping nonferrous alloy castings, an automated cold extrusion complex, etc., all of which were developed by the institute.

As regards economizing on metal and other resources, the NIITavtoprom plan provides for continued development of low-waste and resource-conserving production methods, which include: low-waste stamping of intricately shaped forged pieces (spider and cardan shaft yoke flange type), a production method for hot-rolling bevel gear teeth directly on a forging with no preliminary machining (in the GAZ and ZIL production associations), forming of fine worm-thread ring gears (in moped plants), cold forging of oversized ball pins [sharovyy palets], multidiameter shafts and other parts having a mass greater than 1 kg, all of which were carried out along with specialized production organizations in the Motordetal' Production Association in Michurinsk, at the Avtozapchast' Plant in Dnepropetrovsk and the Kharkov Bicycle Plant imeni G. A. Petrovskiy. Along with several of the sector's plants, the institute will convert to powder metallurgy manufacture of over a hundred more types of parts.

With regard to improving the reliability and service life of motor vehicles, the plan is to continue efforts at BelAZ, in previously organized sectors, in hardening parts for dumptrucks used in open-pit mining by gas-thermal spraying, laser thermal hardening and TVCh [high-frequency current] surface hardening. Plans are being made to increase the use of laser thermal-hardening processes and to set up production lines at the ZIL plant which will be equipped with six special units for hardening ZIL-130 engine cylinder block heads; to introduce the laser hardening process for differential housings, half-axle flanges, gear-box casings and other other parts at KrAZ, MAZ, UralAZ, KamAZ and YaMZ; to develop a model versatile module for laser hardening of all types of cylinder sleeves, which module is scheduled to be introduced, first of all, at GAZ, and which will allow the use of Niresist alloy inserts to be discontinued, and will extend the service life of the sleeves 1.5-fold. GAZ is planning to set up a special section which will be equipped with automatic "PUSK" units for ion-vacuum coating of piston rings for the GAZ line of vehicles, and the Moscow Assembly Unit Plant is planning a detonation spraying department for ZIL-130 water pump housings. The Minsk Motor Vehicle Works is developing a manufacturing process for production of plasma-coated ball pins, which will extend the life of these parts 2-fold (Figure 2).

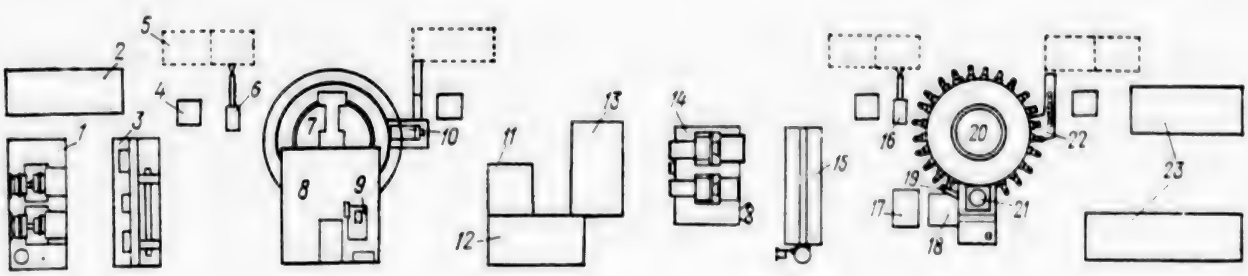

Figure 2. Equipment complex for plasma coating of ball pins:
Key: 1--Hydrostation; 2 and 23--Power supply cabinets; 3--Hydraulic panel; 4--Monitoring station; 5--Production container; 6 and 16--Manipulators; 7 and 20--Revolving tables; 8--Shot-blasting chamber; 9--Spraying chamber; 10 and 22--Discharge devices; 11 and 17--Control console; 12--Power supply; 13--Equipment stores; 14--Hydrostation; 15--Hydraulic panel; 18--Transformer; 19--Inductor; 21--Calibration device

The problematic questions deemed important to the sector have been scheduled as study subjects in the institute's basic research effort. Among them are: automotive industry use of the hyperplastic effect to produce deformation blanks of high-strength cast iron, the search for efficient economical materials for adiabatic-type engine parts, and a number of other problems which will be solved by bringing in help from academic institutions.

Bringing the efforts of NIITavtoprom to fruition in the 11th Five-Year Plan period alone, by introducing the developments worked out by its people, and through setting up the series production of equipment which they developed, and by including institute efforts in the comprehensive planning of plants,

etc., will effect savings of 75,000 tons of metal, 140 million kilowatt-hours of electric power, 5 million m^3 of natural gas, 150,000 [tons] of diesel fuel and 160,000 tons of diesel oil. This will comprise a substantial contribution on the part of the institute toward solving the problems of production efficiency with modern production equipment, and by means of scientific and technical progress.

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MOTOR VEHICLES AND HIGHWAYS

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INSTITUTE'S MOTOR VEHICLE INDUSTRY RESEARCH, DEVELOPMENT

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 12, Dec 84 pp 3-5

[Article by Candidate of Technical Sciences V. A. Anufriyev, of the Central Motor Vehicle and Engine Scientific Research Institute: "Made by NAMI Scientists and Specialists", under the rubric "From Sectorial Science to Production"]

[Text] In his address at a meeting with electors of Moscow's Kuybyshev Electoral District, CPSU Central Committee General Secretary, comrade K. U. Chernenko pointed out that "It is absolutely essential that we insure the rapid and uninterrupted renovation of all sectors of the national economy with the help of modern scientific and technical achievements. This is one of our fundamental tasks. Without this, our society cannot possibly progress."

The sector's scientific collectives are responding to party and government cares concerning the development of domestic machine building by taking on intense obligations to execute the resolutions of the 26th CPSU Congress and the assignments for the 11th Five-Year Plan ahead of schedule, by speeding up scientific and technical progress by all possible means, by placing ever more emphasis on the problems of organizing new, highly effective motor vehicle transport equipment, by taking measures to increase their productivity and provide a high technical level.

The collective of NAMI [Central Motor Vehicle and Engine Scientific Research Institute] is working in close collaboration with collectives of the sector's leading motor vehicle and engine plants on solutions to these problems.

It should be mentioned that development of creative associations with plants has always been characteristic of NAMI's work as the sector's leading institute. This holds true for the 30's, when the foundation was laid for the country's present day industry, as well as for the 50's and the beginning of the 60's, when the institute's close ties with the plants helped to considerably reduce the time spent in developing and putting into production the "Ural" cross-country vehicle, compressed-gas-operated trucks, and air-cooled carburetor engines for compact cars. Subsequently, the role of the association of science with production was more convincingly illustrated by the example of the YaMZ-236, YaMZ-238 and YaMZ-240 line of four-stroke, V-configuration diesel engines, which were developed for the Yaroslavl Engine Works, and which

were in fact based on the theoretical research and design developments which were worked out by NAMI scientists and engineers. Equally characteristic examples are the development and finishing of the VAZ passenger cars, the KAZ truck trailer trains for agricultural use, the "Ural", KamAZ, and new motor vehicle assemblies and progressively-designed units etc.

In the 80's the relationship of the institute with the plants has both deepened and broadened, and its structure has improved; the basic directions have become distinctly defined, in terms of NAMI and the plants carrying out scientific research and experimental design work for the development of new, and modernization of extant,motor vehicle equipment. These efforts include increasing the productivity of motor vehicle equipment, improving the vehicles' reliability, and this means extending their service life and improving their dependability as well as that of all assemblies and units; reducing their fuel and materials consumption, and the labor intensiveness of ATS [motor vehicle equipment] maintenance, as well as reducing repairs and spare parts outlays; raising the level of comfort of the motor vehicle equipment and improving the drivers' working conditions, and improving the ecological qualities of motor vehicle equipment.

The fruits of the collaborative efforts of the institutes and plants of Minavtoprom [Ministry of the Automotive Industry] during the 10th and 11th Five-Year Plan periods, and the results of realizing the indicated scientific research and experimental design work were graphically demonstrated this year at the VDNKh USSR [Exhibition of USSR National Economic Achievements] "Avtoprom-84" Exhibition, the largest in the sector's 60-year history.

The trends in scientific and technical progress can be traced most graphically in the design improvements for the cross-country truck tractors with the 4 X 2 and 6 X 4 wheel arrangements. These improvements include excellent qualities regarding tractive dynamics, fuel economy and low toxicity (smokiness) level, reliability, increased periods between maintenance operations, and its extreme comfort. All these qualities can be found in, for example, the cross-country freight-hauling truck trailer trains, including the MAZ-6422, with the 6 X 4 wheel arrangement, and the MAZ-5432 with a 4 X 2 wheel arrangement, both of which are built at the Minsk Motor Vehicle Works. The progressive technical characteristics were provided according to a characterization of truck types which was worked out by NAMI. The overall number of models in MAZ's new line is quite a bit more extensive than that of their previously produced line of motor vehicles. Suffice it to say that the saddle truck tractors with the 4 X 2 wheel arrangement are the only models which are slated for production in a variety of versions according to the power of the engine, and having "small" (with no sleeper), and "large" (sleeper-equipped) cabs.

The most efficient transmission gear ratios, and reduction of losses therein, and the use of radial tires and improving the aerodynamic qualities of truck trailer trains by installing fairings,save considerable quantities of fuel.

Vehicle cabs are spacious and comfortable, have a large triple-layered windshield and wide side windows, and are equipped with a variety of equipment. The ease of operation of the steering wheel, pedals and levers are another contribution to comfort, and to the reduction of driver fatigue.

NAMI, working with a motor vehicle plant, has developed a standardized steering mechanism for a line of large-tonnage vehicles. The driver's seat has been designed with consideration made for ergonomics, is spring-cushioned and is adjustable for height, back tilt, and moves forward and back.

Institutes, including NAMI, design bureaus and sectorial plants, play a very important role in the realization of the assignments stemming from the USSR Food Program. Among the most important of these are the efforts to develop and get into production radically new special-purpose diesel-powered trailer trucks during the 11th Five-Year Plan.

In addition to the new KAZ trailer truck described in the trade journal AVTOMOBIL'NAYA PROMYSHLENNOST', which was developed by NAMI, YaMZ, KAZ and the Main Trailer Design Bureau (in the city of Balashov) and produced by the Kutaisi Motor Vehicle Works imeni G. K. Ordzhonikidze, NAMI and UralAZ have developed a more powerful 14-ton tractor trailer based on the "Ural 5557" 7-ton truck tractor with a 6 X 6 wheel arrangement, on the basis of which, aside from the purely transport-related modifications, there are plans to produce models designed for the placement of organic and mineral fertilizers. This vehicle has been in operation since the end of 1983. Both of these new tractor trailer models received high marks from agricultural specialists during acceptance and operational tests.

The sector has developed a wide range of agricultural diesel truck trailer trains for operation in less rugged road conditions. These vehicles are based on new GAZ, ZIL and KamAZ models with load-carrying capacities of 9-14 tons, the introduction of which will sharply reduce agricultural outlays by reducing fuel expenditures, increasing service life prior to major overhaul, etc. Thus, the GAZ-6008 dumping truck trailer train, with a payload of 8.6 tons, put together as a dump truck with a 4 X 2 wheel arrangement, and towing a trailer, is designed to haul different kinds of freight in predominantly agricultural areas along all kinds of roads. The beds of the dump-vehicle and trailer each have two capacities--by either not installing additional sideboards, such as when hauling basic agricultural loads, or their volumes can be increased by adding sideboards, which permits the full load-carrying capacity of the truck and trailer to be used when hauling loads of small-volume materials. The increased-volume beds are supplied with a tipping plate [perekidnoy kozyrek] to keep down freight losses during loading. The dump vehicle is powered by an air-cooled four-stroke diesel engine which puts out 92 kilowatts, the prototype for which was developed by NAMI scientists and specialists: it is highly reliable and has a long service life and is relatively small (as a result of the use, in the designs for its assemblies and units of new, progressive solutions and materials).

The role of the motor vehicle industry and its specialists play a critical role in the realization of the USSR's Power Production Program. The sector is faced with the task of increasing its production of heavy-freight dump trucks which will haul some 70 percent of the raw mineral riches obtained through open-cut mining.

NAMI specialists, in collaboration with sectorial plants, are participating in the development and upgrading of BelAZ 75-, 110- and 180-ton dump trucks which are used in open pit mining. And much credit is due to the institute's scientists, engineers and workers for the fact that these truck designs are successfully passing tests in severe Siberian and Polar conditions.

The work being done by scientists of NAMI, VKEIavtobusprom, and other of the sector's organizations to improve the country's passenger transport is currently urgent (45 percent of the total volume of passenger transport is handled by general-use bus transport). These scientists have made their own worthy contribution toward improving the structure of the bus fleet, and have proposed a whole complex of measures designed to improve the technical and operational indicators of production buses, primarily their useful life, and have developed special vehicles (the NZAS-4947 and the NZAS-3964) for operation in the conditions of the Far North and Eastern Siberia. The production of special vehicles designed to transport people in the extremely difficult road conditions of regions with a harsh, predominantly cold climate is an uncommon occurrence, if not the only one of its kind in the world.

One of the most important directions in the improvement of motor vehicle technology is the improvement of fuel economy. In particular, in accordance with the decree of the CPSU Central Committee and the USSR Council of Ministers, "Basic Directions and Measures for Improving Efficiency in the Utilization of Fuel-Energy Resources in the National Economy for the Years 1981-1985, and for the Period up to 1990", sectorial scientists and specialists have set themselves the task of reducing the fuel consumption of vehicles which are in production, being upgraded, or are being readied for production, which will bring about a substantial, step-by-step reduction in the fuel consumption of vehicles for both carburetor and diesel engines; and the basic models and modified versions of motor vehicle engines have been upgraded, with a concomitant improvement in the indicators for fuel economy and oil outlays. Using the work done by NAMI as a basis, commercial designs have been developed for new economical diesel engines: the eight-cylinder ZIL-645 (Figure 1--figure not shown) at the Moscow Motor Vehicle Works imeni I. A. Likhachev, the GAZ-542.10 air-cooled six-cylinder diesel engine at the Gorkiy Motor Vehicle Works (Figure 2--figure not shown), and the four-cylinder NAMI-VAZ, developed at the Volga Motor Vehicle Works imeni 50-letiye USSR. NAMI continues to take an active part in the testing and developmental finish work on these diesel engines, as well as in the development of modifications for them, such as turbo-supercharging, for which the institute has developed a series of turbocompressors, typed by size. For example, on the ZIL-645 diesel engine, they have effected a process for volume-wall [ob"yemno-pristenochnyy] carburetion, a high-pressure plunger-pump fuel-feeding system with dual-orifice enclosed injectors, and the cooling fan drive is equipped with a disconnecting coupling. The engine puts out 136 kW of power, has a minimum specific fuel consumption of 217 g/(kW hour), and normally runs 400,000 km before needing a major overhaul.

Carburetor engines are also undergoing improvements. The development of the ZMZ-53-11, ZIL-130 and ZIL-375 engines, with their swirling-motion fuel charge, should be ranked among the significant of the institute's design developments of the 11th Five-Year Plan period in this field. Additional swirling of the air-fuel mixture during the intake stroke, as occurs in these engines, creates conditions which permit leaner mixtures to be burned, and increases the compression ratio, thereby reducing operational fuel expenditures by 5-7 percent with no increase in demands for fuel having a higher octane rating. The simplicity of the design resolution permits production of these modernized engines on existing production equipment.

Efforts are being expanded for the use of electronic control for vehicle power assemblies, which will reduce fuel consumption as well as the toxicity of exhaust gases. Thus, as long ago as 1983, prototypes of modernized RAF buses were set up with and earmarked for the testing of electronically-controlled fuel injection systems. According to the data from the tests, the use of electronic control systems would reduce fuel outlays for a haul cycle by 5-7 percent.

Efforts are being made to improve transmission design and characteristics to reduce fuel outlays and increase the vehicles' performance curve. Thus, a three-speed hydromechanical transmission has been developed and introduced for LAZ-4202 and LiAZ-5256 buses, which provides a 3-5 percent reduction in fuel outlays. The IZh-2126 (Figure 3--picture not shown) gear-box, for Izhevsk Machine Building Plant passenger cars, reduces fuel outlays an average of 8 percent. The eight-speed gear box developed by NAMI and introduced by KAZ (in the new KAZ-4540 vehicle), improves this vehicle's fuel economy by 8-13 percent. The transmission gear ratio for the "Moskvich" and VAZ vehicles has been optimized, reducing fuel consumption by 4-6 percent.

Fuel consumption for the LAZ-695M bus saw an average reduction of 9 percent, at 5 percent for the LAZ-4202 bus, as a result of improving the gear ratio for the final drive. Improvements in vehicles' aerodynamic qualities and the changeover to radial tires is also helping to reduce fuel consumption. And practically all of today's new passenger car models are equipped with steel-belted radial tires, which have low rolling resistance, and give a 3-5 percent saving of fuel. The institute's specialists are making provision for efforts to improve the characteristics of mass for motor transport vehicles, which will insure an appreciable reduction in specific fuel consumption (per ton of freight hauled).

Alternative fuels, and compressed natural gas in particular, have also been assigned an important place among NAMI's efforts. Series production of ZIL and GAZ vehicles, which operate on this fuel, has already started.

Achievements in the field of cryogenic technology are permitting still another step forward as regards the use of natural gas as a motor vehicle fuel. Minavtoprom has also developed ZIL and GAZ vehicles which operate on a comressed natural gas--methane--which is stored aboard the automobile in cryogenic Thermos cylinders at a temperature of 23° Kelvin. Cryogenic technology has also turned out to be extremely useful in the development of the small YerAZ-37302 refrig-

erated trucks. The refrigerating plant, which contains 100 liters of liquid nitrogen, provides improved preservation and quality for the products delivered to the trade network and the public catering enterprises, and reduces the production costs for transport.

Research work has also been done lately regarding the use of non-petroleum-based fuels such as methanol, hydrogen, and compounds made of these two with regular fuels.

Efforts to increase service life and reliability have always been one of the most important thrusts in the field. Thus, motor vehicle and engine service life was increased 1.3-1.5-fold during the 10th Five-Year Plan period. These efforts have been continued on into the 11th Five-Year Plan period. At the "Avtoprom-84" exhibition, for example, there was an exhibit of a system for the testing and operational development of motor vehicle equipment, thanks to which, specialists from NAMI, its Central Scientific Research Motor Vehicle Proving Ground, the Northern Motor Vehicle Testing Station, and from experimental production vehicle fleets are able, in much less time, to resolve the problems of extending the service life and failure-free performance time of motor vehicle equipment, in particular by analysing the test data from breakdowns and malfunctions of primary assemblies and units, to work up recommendations for extending their service life.

The application of new paintwork materials, with their improved protective properties, as well as the methods by which they are applied, aid in extending the service life of motor transport vehicles and equipment. That is exactly why the anticorrosion resistance of these coverings is expected to increase in the years ahead to 10-12 years for bodies and cabs, and up to 6-8 years for chassis components through the use of cathodic electrolytic precipitation.

The use of pre-painted metal in the manufacture of the vehicle panels which are most subject to corrosion will increase motor vehicle durability. Anticorrosion protection of non-visible sections of bus and passenger car bodies, and of the cabins of special-purpose vehicles is finding wide application.

As has already been touched upon, enterprise design services and NAMI specialists are making a systematic effort to reduce the metal content and metal outlays in designs for motor transport equipment. Thus, KamAZ has introduced the high-strength, low-alloy 22 G2TYu-quality steel for KamAZ 5511 dump truck frames, which increases the load-carrying capacity of these trucks by 3 tons (from 7 to 10 tons), and which thus reduces the frame mass by 135 kg; KrAZ has introduced a curved upper frame member [nadramnik] for the KrAZ-256B1 dump truck, which reduced the frame mass by 115 kg, and so on. In general, it should be brought out that the mass of the parts, assemblies and units (for trucks) which have the highest metal content are to be greatly reduced during the 11th Five-Year Plan, and this includes frames and bodies--by 10-13 percent, beds--by 10-15 percent, wheels--up to 30 percent, cardan shafts--by 15 percent, and splash guards and other of the larger components--up to 50 percent. One of the ways to solve the problem is to use aluminum alloys. As an example, let us refer to the Minsk Motor Vehicle Works series production

of their semi-trailer, which began in 1983: by replacing the steel sections with aluminum, the load-carrying capacity of the semi-trailer was boosted by 250 kg, and 500 kg of steel rolled metal stock was saved in the manufacture of each unit of this transport equipment. The same objective is achieved by using plastics, the average use of which will be increasing in the very near future, for the passenger car, 3.2-fold (25 and 80 kg); for trucks, 8.4-fold (8.4 and 70 kg) and for buses, 2.9-fold (60 and 175 kg). This will apply mainly to the larger components, such as hoods, fenders, splash guards, radiator shells and vehicle tail assembly blocks from prepregs.

The "Avtoprom-84" exhibition also had things to say about many of the sector's other achievements. But we shall dwell only on the results of research in the area connected with the human himself, and his environment--i.e., in the field of human engineering as it relates to the motor vehicle, to the preservation of the environment, and also the reduction of noise levels.

So, in order to greatly alleviate the effort put forth by the driver in operating the clutch pedal and the gearshift lever, to improve his safety on the road, to improve the vehicles' hauling and speed characteristics, to reduce the toxicity of the exhaust gases by cutting down on the number of transient conditions, and to increase the vehicles' comfort, NAMI and VKEIavtobusprom specialists (with the assistance of specialists from the UVMV [not further expanded] Institute of the CSSR) have developed a line of hydromechanical transmissions for the LiAZ-677, LiAZ-5256 and LAZ-4202 buses, the "Ikarus", the "Skoda", and for compact passenger cars (one of which, the three-speed, type 19.17 transmission (Figure 4--picture not shown),is designed for engines with a 150-190 kW capacity, and has a transformation ratio of 2.5-2.8). All of them provide smooth shifting with no interruption in transmitted power (this due to the hydraulic control system which automatically adjusts the pressure of the hydraulic transmission fluid).

In order to protect the environment and save fuel, the battery-driven VAZ-2702 van was developed for route transport of small parties of people in cities. Its excellent visibility, the comfortable seating accomodations for the driver and passengers, the improved heating and ventilation system, the ease of control and the low noise level, which is an unsurpass d 74 dB(A), insure the comfort and reduce driver fatigue considerably, while providing safety in stressful city driving conditions. In order to reduce the stationary mass of this battery-powered vehicle, the frame, body and cab were made of aluminum alloy, which enhances its load-carrying capacity for a run through a single "charge-to-discharge" cycle of the storage batteries. The vehicle has a range of 85 km at a speed of 40 km/hour in city driving conditions.
New motor vehicles from KrAZ were displayed at the exhibition, in part The KrAZ-260 motor vehicle and the KrAZ-250 and KrAZ-6505 undercarriage, equipped with the new all-metal cab, were among the KrAZ vehicles on display at the exhibition. Its window area has been increased, which, combined with the convex rear-view mirror, improve the visibility, and interior noise has been reduced through the use of new noise- and thermal-insulation materials.

In conclusion it should be emphasized that, as the materials shown at the exhibition demonstrated, the sector's collectives of scientists and specialists have shown indisputable progress during the last decade in getting their developments into production. This is a guarantee of new achievements in the further development of domestic motor vehicle construction.

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MOTOR VEHICLES AND HIGHWAYS

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USE OF PLASTICS IN SOVIET MOTOR VEHICLE INDUSTRY

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 11, Nov 84 pp 22-24

[Article by Candidate of Technical Sciences A. I. Belov, of the Higher Technical School-Plant, attached to the Moscow Motor Vehicle Works imeni Likhachev:, "The Use of Plastics in Motor Vehicle Construction", under the rubric "Materials Technology"]

[Text] The expansion in the range of uses of polymeric materials in designs in motor vehicle technology, and the rapid growth of plastics use in motor vehicle building are due to the fact that they help solve such critical problems as reducing the structural mass, and consequently reducing fuel outlays, they increase service life and improve corrosion resistance, they promote a more rational use of metal, and they increase the comfort of the vehicles.

The 1940's saw the first attempts at using plastic in motor vehicle construction. This was, however, an expensive and technologically inefficient area of production. The development of polymer chemistry in the 50's and 60's, and the emergence of new plastics and highly productive technological processing methods led to the widespread use of polymeric materials in the bodies of amphibious vehicles, in the cabs of special-purpose vehicles and in passenger car bodies. The automotive designs which were developed singly in those years are also series-produced in the several tens of thousands to the present day. But at the presently developed level of the motor vehicle industry, the introduction of techniques which insure a yearly output of several hundreds of thousands of units is believed worthwhile. This very likely explains the fact that the number of metal bodies far surpasses the number of plastic bodies for the time being.

Meanwhile, the leading foreign motor vehicle firms have increased their use of plastics 5-8-fold in the last 10-15 years. For example, western European firms have raised the volume of plastic used [illegible] single motor vehicle up to 70-80 kg, and French motor vehicle builders [illegible]ve developed a prototype vehicle for the 1990's which is based on the Peugeot-305. It is called the "Vera", and plastic accounts for 22.6 percent (167 kg) of its mass.

In the USSR, during this current decade, a trend toward the increasing use of polymeric materials in the automotive industry has also become noticeable. Thus, if 1970 saw an average outlay of 14 kg of plastic used for a single

passenger car, and this rose to 23 kg in 1975, then it reached 30 kg in 1980. At the AZLK [Moscow Motor Vehicle Works imeni Lenin Komsomol] starting in 1981, production of the Moskvich-2140 Lux passenger was begun. This model contains 63.6 kg of plastic. This indicator is high for the VAZ-2107 [Volga Motor Vehicle Works] as well, and comes to about 70 kg.

At first the plastic parts were used as decorative touches for vehicles, and performed a primarily aesthetic function while enhancing the comfort of the vehicle's interior. Then plastics came to be used as structural material. The strength and operational qualities needed for plastic motor vehicle parts was obtained by reinforcing the polymers, as well as by filling and modifying them, i.e., through the use of composite materials for motor vehicle structures. Modifying the polymers with substances which are different as to their chemical nature increases their operational qualities, such as thermal stability, and resistance to freezing. Fillers reduce the cost of the compositions and improve their production characteristics--their moldability is enhanced, and they shrink less. Reinforcement with organic or mineral fibers is used mostly to increase the strength of polymer composite automotive materials. Thus, the use of plastics as structural materials has increased the proportion of plastics in motor vehicle design. At present, models have been worked up, and preparations are being made to produce new VAZ, ZAZ [Zaporozhye Motor Vehicle Works] and AZLK vehicles, in which 55-90 kg of plastic are used to make parts for a single automobile.

Next in turn is a new stage in the use of plastics in automotive engineering. The properties of composite materials, depending on the relation between their components and their makeup, can be changed. This principle forms the basis of creating, and "building" a material, and calculating on manufacturing a specific automotive part of it. Let us turn for examples to the development of the freeze-resistant polypropylene bumper (Figure 1--Figure not shown), which must be usable in the 313-323° Kelvin temperature range, and the plastic fuel tank (Figure 2--figure not shown), the material for which was given special properties to prevent the accumulation of an electrostatic charge as well as the diffusion of fuel. Both of these products were shown at the "Plastics in Motor Vehicle Building" exhibit, held at the Higher Technical School Plant of the ZIL [Moscow Motor Vehicle Works imeni Likhachev] Works.

At the exhibition, the participants of which were the higher technical school's base enterprises and leading sectoral scientific research institutions, models of domestic and foreign plastic automotive designs were demonstrated. Automotive body and trim elements were widely shown, as well as parts found beneath the hood and in vehicle interiors, and running gear support structures.

Thus, despite the higher cost (compared to traditional structural materials), plastics are finding ever wider use in automotive designs. Determining the amount of plastic in a motor vehicle by its mass, which amounts on the average to about 10 percent, does not always give a correct notion of its share.

Taking into account that the density of plastic is 4-fold less than that of steel, we note that the share of plastic making up the vehicle's volume can attain several tens of percentage points. The "Plastics in Motor Vehicle Building" exhibition showed that the rational use of polymeric materials always makes it possible to achieve a concrete effect. The parameters for effectiveness can be varied. We shall show a number of examples associated with the designs which were demonstrated at the exhibition.

1. Reduction of mass. This is practically always one of the results attained when a metallic part is replaced with plastic. Here, taking conditions for equality of strength into account, the mass obtained in this fashion is, on the average, 2-fold less. Thus, the VAZ motor vehicle wheel (Figure 3--figure not shown) which was shown at the exhibition, and which is made of glass-filled polycarbonate, weighs 3.4 kg, whereas a steel wheel has a mass of 7.0 kg. In this case, the vehicle's overall mass is also reduced, and this influences the operational efficiency of the suspension members, improving the smoothness of the ride. The hood-fender assembly (Figure 4--figure not shown), for trucks, which is made of LFM [sheet molding material], and reinforced with 28 percent fiberglass, weighs 86 kg, also 2-fold less than a similar metallic assembly.

2. Savings in scarce materials. Replacement of steel body panels with plastic makes a large quantity of metal available for use in the manufacture of essential assemblies. For example, stamping the transmission case inspection cover for a ZIL vehicle out of AP70-151 semifinished plastic effects a saving of rolled steel of over 120 tons.

SAM-3 antifriction material and other polyamide-based compositions are being used to advantage for replacing bronze and brass parts in friction assemblies. Large quantities of such materials as zinc, aluminum and copper are saved by manufacturing automotive lighting assembly housings out of plastic.

3. Improved comfort. The interior of a modern motor vehicle cannot be built without wide use of plastics. This view is promoted by the subjective factor of the comfort of the driver and passengers, as well as by such an objective factor as the reduction of the noise level inside the vehicle down to a level of 65-70 dB (A).

4. Corrosion resistance. Plastics have excellent properties of resistance to water, mud, and other corrosive media which are characteristic of motor vehicle operation. The fenders of the Mercedes automobile, which are made of finely-honeycombed polyurethane foam and the mudguards (Figure 5--figure not shown) of the ZIL automobile illustrated this very parameter of effectiveness at the exhibition.

5. Vehicle layout. Efficient utilization of the unused space was permitted by using plastics in the gasoline tank design. Thus, the tank for the VAZ-2108, which has an extremely complicated shape (50 liter capacity) weighs 5.5 kg.

6. Aesthetics and aerodynamics. The oversized, intricately formed plastic panels are a perfect complement to the automobile's architectural style. They also fulfill an aerodynamic function. One of them is the spoiler, designed as part of the bumper), which reduces the head drag coefficient (to s_{kh}=0.36), and which improves the vehicle's high-speed stability. Use of a glass-reinforced plastic deflector (fairing) mostly by truck-tractors with a high semitrailer,reduces the head drag by 20 percent.

7. Passive security system. The injury-preventing instrument panel-dash, which is made of finely honeycombed polyurethane foam, modified polypropylene and polyphenylene oxide meets the strict requirements of the international standards for passive security. It was in fact these very standards which brought about the need to develop plastic bumpers. The oversized panel (Figure 6--figure not shown) on the front of the vehicle body is an outgrowth of the energy-absorbing bumper design, and encompasses within itself the functions of a bumper, spoiler, radiator shell and fenders, and makes up the so-called "soft face".

8. Labor intensiveness. The above example of the large-size body panel reflects the multipurpose design of these assemblies, which serve as passive security, are aerodynamic, and which reduce labor intensity in manufacturing. This part, designed to replace an entire unit made up from a large number of stamped metal parts, is manufactured in one operation. As a result of having developed this "integral" panel, the number of assembly and welding operations is reduced, the amount of equipment needed is reduced, and the production area can be reduced as well.

The experimental designs developed here in our country and abroad for large-size automotive "integral" panels and the use of technologically efficient polymeric composite materials are making possible the application of a new principle of automotive construction--the component assembly of large plastic units (modules), such as the front and rear sections of motor vehicle bodies, roofs, etc. In so doing, the support system undergoes an alteration--once again the vehicle is made via (as was the case during the outset of motor vehicle body construction) panel and chassis assembly. Many design bureaus give due consideration to this principle as they work on automotive designs for the year 2000.

At the present time there are 350 million passenger cars in operation in the world, and about 30 million were produced in 1982. The stringent requirements for quality which are part of the massive programs for the products of the automotive industry are engendering a situation wherein use of the indicated progressive materials is turning into a large-scale social and economic problem. Suffice it to mention that the demand for polymeric materials in the leading automotive countries of Western Europe comes to 650,000-700,000 tons per year, to 120,000 tons in Italy, and 300,000 tons of plastics in the FRG. The needs of our domestic motor vehicle builders can be estimated as falling within this range.

Among the urgent problems which face the automotive industry as it moves toward finding solutions to the problems given above are the following:

production of the needed quantities of high-quality raw materials (polymers and reinforcing materials);

enlarging the sector's processing works so as to provide plastic parts for models in series production, and for future models, at a stage preliminary to production;

to reduce the cost of polymers and to develop a procedure for determining their technical and economic effectiveness, with consideration taken for actual overall energy outlays on a national economic scale. Such a procedure should stimulate the use of plastics.

The motor vehicle industry, as the most dynamic sector involved in large-scale production, may be the largest consumer for plastics.

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MOTOR VEHICLES AND HIGHWAYS

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DEVELOPMENT OF NEW MATERIALS FOR MOTOR VEHICLE INDUSTRY

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 12, Dec 84 pp 6-7

[Article by B. G. Karnaukhov, of NIIATM (Scientific Research Institute for Motor Vehicle and Tractor Materials): "New Materials for New Equipment"]

[Text] During the years of the last several five-year plan periods, the largest motor vehicle Works in Europe--VAZ and KamAZ--have come into operation, as well as an entire series of motor vehicle assembly and special-purpose plants which were developed to produce dump trucks and trailers, motor vehicle electrical equipment, instruments, bearings, and hundreds of new motor vehicle equipment models. This new equipment has required new materials, and these materials have been developed. Suffice it to say that during this very period our domestic industry initiated production of over 500 types of new materials needed by the motor vehicle-building sector, and over 1,500 types which were supplied for the special technical conditions which are making the operative standards' requirements more rigid. More than 60 scientific research institutes and 200 plants took part in the development and assimilation of these materials. The technically grounded requirements which were put on the materials, and their testing and implementation in sectorial plants were all carried out by NIIATM specialists.

As examples of the new materials developed for the sector, we can cite the steel used in diesel engine crankshafts and truck frames; the economically alloyed steels used in the transmission gears and rear axle reduction gears; the low-alloyed steels used in dump truck bodies; the high-strength and alloyed cast irons used for body parts; the aluminum alloys used in engine parts; the complex of polymeric materials used to trim the cabs and in the manufacture of motor vehicle components; and the anti-corrosion materials used to protect motor vehicle equipment parts.

These materials have allowed many of the processes used in manufacturing assemblies and parts to be automated, have extended the service life, and have reduced outlays of labor and assets used in servicing the motor vehicles. And thanks to these materials, several other problems have been solved.

In particular, the use of new paintwork materials, artificial leathers and leak-proofing materials which are weldable by high-frequency current, new electroplating materials, plastics, mastics and sealants have made possible

a marked improvement in exterior and interior finish work, improvment in the passive safety equipment, in corrosion resistance, and in vibration, noise and heat insulation for the cabs of motor vehicles, buses, trolley buses and subway cars. The use of new adhesives has, in many instances, made it possible to do away with welded and riveted joints and seams, i.e., to increase labor productivity many times over. And the same results have been effected by the use of cermet and polymer inserts in ball joints, of new lubricating greases which are put in as the assemblies are manufactured, and new anti-freezes, brake fluids and windshield washing liquids have provided the vehicles with reliable operation in a variety of climatic conditions at temperatures from 233 to 323 Kelvin (from -40° to +50° C).

Thanks to these new materials, impressive successes have also been achieved in the area of motor vehicle equipment production methods. Thus, the wide-spread use of automatic cold stamping presses stems from the development of rolls of thin-sheet cold-rolled steels with high properties of plasticity and high surface-finish quality. Other materials have helped to improve the quality of forgings, to reduce wear on the dies, to reduce metal outlays in the forging process (rolled stock of improved precision, turned and ground, and lubricants for hot stamping dies), to increase productivity by 30-50 percent and to increase the strength of tools used in machining metal by cutting (steels containing lead, special lubricating and cooling fluids), in using a highly productive process in the manufacture of parts by cold heading, which reduces metal outlays and improves the quality of the products (sized and turned metals for cold heading) and special types of sections which reduce metal outlays and increase labor productivity.

The achieving of the highest possible technical and economic effect during the development of the newest motor transport equipment also assumes structural improvements in the volumes at which new and traditional materials are used. For example, the sheet steel use should increase by 3-5 percent (by reducing the use of bar steel and, in certain instances, of cast steels); use of rolled aluminum stock, which is used in the manufacture of truck beds, bumpers, radiators etc., should increase almost 2-fold, and the mass of parts made of structural plastics will increase (up to 60-80 kg for passenger cars, and up to 30-70 kg for trucks) etc.

One of the most important characteristics of the modern motor vehicle is its fuel economy. This factor depends, to a great extent, on the vehicle's stationary mass. That is why the introduction and widespread use of low-alloyed steels will become one of the primary means of improving fuel economy in motor vehicle technology while simultaneously saving rolled metal stock.

To handle this problem, in 1983 NIIATM completed the development of their 08GSYuT, 08GSYuF and 07GSYuF low-alloy, cold-rolled sheet steels and introduced them at AZLK, VAZ, GAZ and ZIL plants. And here are the results.

The use of low-alloyed steel in the manufacture of longitudinal frame members for the Moskvich-2140 motor vehicle reduced its mass by over two kg, and the same steel used in seven parts for a VAZ vehicle reduced its mass by 2.2 kg.

Excellent results have been obtained at BelAZ by using high-strength 20G2BFTs steel, which reduced the mass for dump trucks used in open pit mining by 600 kg.

A large reduction in motor vehicle mass can be obtained through the use of two-phase steels with a ferrite-martensite structure. These steels are characterized by a low yield strength to ultimate strength ratio, high values for uniformity and overall elongation, and for their strain hardening index. The initial results from tests of an experimental commercial lot of these steels showed that by using them the thickness of a sheet of metal can be reduced by 15-20 percent with no loss in strength, and that these steels should be used widely, primarily in the manufacture of the power-consuming components which make the motor vehicle safe, such as the bumpers and wheel disks, and the frontal components, with their complex shapes, such as the fenders, hood and trunk panels, and the outside door panels.

As was previously mentioned, the use of rolled aluminum stock in place of steel will increase 2-fold. This substitution reduces the mass for the parts up to 40 percent, and at the same time boosts the load-carrying capacity of motor transport equipment, while reducing the labor intensiveness of assembling the onboard vehicle beds, trailers and semi-trailers.

There is already some experience in this replacement. For example, in the BelavtoMAZ Production Association, aluminum sections have been used for MAZ-9397 semi-trailer sections, and this reduced its mass by 20 percent. The design of the bed of the KamAZ-53212 trailer truck equipped with the SZAP-8352 trailer is also notable for its progressive design resolutions. Here, the designers have almost completely gotten away from bolted joints, and utilize locking joints for the sections. The load-carrying capacity for this trailer truck has been increased by a ton.

But aluminum plays a special role in the development of equipment for the agricultural equipment industry. The large-capacity freight semi-trailer trucks and refrigerated trucks with capacities of 12 and 22 tons are to be made almost totally of aluminum, with their bodies and floor boarding and cargo-carrying units made of compression-molded sections. For example, the prefabricated construction of the ZIL-MMZ-554 dump truck bed, which is used for hauling unpackaged mineral fertilizers,reduces the vehicle's mass by 300 kg and reduces the labor intensiveness of its construction sharply through the elimination of welded seams. Another promising direction is the use of aluminum rolled stock to make radiators, especially in the manufacture of heating and cooling radiators, the mass of which, thanks to their composition, is reduced by 60-70 percent. Aluminum alloys, which are slated for use in prospective motor transport equipment designs, are counted among the highly technologically efficient alloys. These are the type AD31 and 1935 alloys, to be used in the manufacture of compression-molded sections, and the type AMT2 alloy for rolled sheet stock. The use, however, of type V95 high-strength alloys for high-load parts such as front axle beams has not been ruled out.

But particularly drastic reductions in the mass of motor transport equipment (up to 50-60 percent) have been achieved by replacing rolled metal stock with structural plastics. This is the precise reason there are plans to use up to 70 kg of plastics per automobile on the new VAZ-2108, from the Volga Motor Vehicle Works imeni 50-letiye USSR. Plastics are to be used for the larger components, such as a frameless instrument panel, front and rear energy-absorbing component groups, the molded vehicle roof, headlight housings etc. The use of plastics in the manufacture of motor vehicle parts and assemblies helps to increase labor productivity, and makes possible the manufacture of intricately-shaped multi-purpose and integrated components made with narrow tolerances with no additional machining.

The basic structural plastics used in present-day motor vehicle manufacture are polyphenylene oxide, polycarbonate, polyethylene, polypropylene, polybutylene terephthalate, polyformaldehyde, polyamide ABS plastics, reinforced plastics which use polyester and epoxy binders, and prepregs. For example, radiator grills made of ABS plastics are approximately 7-fold lighter and 50 percent less costly than those of metal. Their use on VAZ motor vehicles and the Moskvich passenger car has saved up to six kg of zinc alloy on each vehicle. The introduction of parts made of prepreg on KamAZ motor vehicles has saved about three kg of rolled steel stock for every kg of plastic used. On the whole, the upcoming decade will see the sectorial demand for low-alloy steels increase 3.5-fold, with aluminum demand growing 2.3-fold and plastics--2.6-fold.

The exhibits at the Avtoprom-84 anniversary exhibition have told all about this.

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DEVELOPMENT OF ELECTRICAL DEVICES FOR MOTOR VEHICLES

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[Article by Candidate of Technical Sciences V. M. Nabokikh, of NIIavtopriborov (Scientific Research and Experimental Institute of Motor Vehicle Electrical Equipment and Automatic Instruments): "The Soyuizavtoelektropribor (All-Union Motor Vehicle Electrical Instrument Production Association)--Leading Developer of Electrical Equipment Products for Motor Vehicles and Tractors"]

[Text] A motor vehicle and tractor electrical equipment subsector produces about 3000 type sizes of electrical equipment, instruments, electronic products and spare parts for them, for motor vehicles, tractors, motorcycles, combines and agricultural machinery. These products help to solve problems of fuel economy, they reduce the toxicity of exhaust gases, provide safe travel and comfort for passengers and drivers, as well as much more. And their role, especially in the context of the introduction of electronics and microprocessing systems, is constantly growing. At the same time they characterize the technical level of motor transport equipment. This is why so many places at the Avtoprom-84 exhibition were allocated, not only to series-produced, but also to prospective models of motor vehicle and tractor electrical equipment.

For example, among the equipment which was displayed, there were microprocessor control systems for truck and passenger car engines. One of them (Figure 1--picture not shown)--an engine control system for ZIL and GAZ trucks and LAZ and LiAZ buses--increases the fuel economy of the motor transport equipment just mentioned by 5-7 percent, reduces exhaust gas toxicity, and improves cold engine starting. Soon, as follows from the exhibition materials, development will be completed on new, standardized electrical equipment for the new Don, Sibiryak, Niva and Kolos tractors and combines, and KAZ-4540, Ural-5557, GAZ-4509, VAZ-2121 and LuAZ-968M agricultural motor vehicles.

Production is being started up on electrical equipment for motor vehicles which are earmarked for use in the North, and this includes special Vebasto preheaters and other items.

Right now, as is well known, the primary requirement for motor vehicle and tractor generators is that of increasing their capacity. These are precisely the qualities found in a new series of motor vehicle generators which have

been developed and recently put into production, and whose indicators for materials utilization have been increased 1.3-1.6-fold. As an example, we can use the model 16.3701 generators (14 volts, 900 watts) used in GAZ motor vehicles, the 32.3701 generator (14 volts, 750 watts), used in ZIL trucks, and the 37.3701 generator (14 volts, 750 watts) used in VAZ passenger cars (Pictures 2, 3 and 4, respectively--pictures not shown). There is also a generator for two voltage levels (the model 38.3701; 14/28 volts and 1000 watts) which has been developed, and is designed for diesel-engine trucks, and allows the use of a 24-volt starter with motor vehicle equipment rated at 12 volts. At the same time, production of integral regulators, which will mate up with the new generators, is being increased, which regulators have an increased excitation current, and have been in production since 1984. Production of the standardized 46.3701 generator (14 V, 700 W), (and with its materials utilization index increased 1.75-fold) began in 1984. This generator can be used on all tractor models. Hereafter, these generators will replace all series-produced generators of lesser output.

A new series of generators (26.3701) has been developed as part of a set with a 251.3734 "commutator-stabilizer" block (7 V, 45 W) and the 43.3701 (Picture 5--picture not shown) which makes up a set with the 261.3734 block (7 V, 65 W), and is for motorcycles, mopeds and velocipeds. Their materials consumption is 1.3-2-fold lower than series-produced models, and their output has been increased (by replacing the iron-nickel alloy magnets with oxide-barium magnets). As in the case of the generators, the main developmental direction for new starter designs is that of increasing their specific power. From the exhibition information, we gather that a new series of modernized starters has already been developed and put into production. The output of these starters has been increased by 10-20 percent, and they are for basic motor vehicle models with carburetor engines. This series uses an end commutator, which allows the mass and size of the generators to be reduced. For example, the 26.3708 starter (Picture 6--picture not shown), for VAZ motor vehicles has had its output increased to 1.4 kw and its mass decreased by 2 kg.

In the area of modernizing the electric drive, the plan is to change over to production of electric motors from permanent magnets. By the end of the current five-year plan period, the metal consumption of electric motors and overdrive units [motoreduktor] will be reduced 1.5--3-fold compared to 1980.

When developing motor transport lighting and signalling systems, vehicles must be provided with signal-light devices complying with the international YeEK [Unified Electrical Code] of the OON [United Nations] rules, and in this connection, the design must meet the requirements for a high degree of precision and purity in the manufacture of the elements, as well as for low metal consumption. And this problem has been solved: all motor vehicles will be fully equipped, during the 11th Five-Year Plan period, with headlights with European light diffusion, and during the 12th Five-Year Plan period, all headlights are to be equipped exclusively with halogen lamps. In addition to the new headlight units, a number of large and small modular rectangular headlights (Picture 8--picture not shown) have been developed for passenger cars, and are already being installed on the GAZ-3102 Volga, and are slated for use on KamAZ and ZAZ motor vehicles, as well as buses.

During four years of the 11th Five-Year Plan over 30 types of signal lights have been modernized or redesigned. They are all equipped with plastic housings. The modernized, and new, lights meet the requirements set forth in the international regulations and should replace all signal lights now in use in transport.

In order to improve motor vehicle driving safety, a variety of windshield wipers, one of which is the three-bladed, two-speed 13.5205 unit, has been developed by NIIavtopriborov, and cleans a large expanse of the windshield.

The Avtoprom-84 exhibition demonstrated that improving electrical equipment for motor vehicles and tractors is proceeding not only along lines of design improvement, but also in the direction of improving the quality of the products and their reliability and service life. The following fact attests to the results of this work. The proportion of the output which has been certified as belonging to the highest category of quality of the overall volume of marketable products at the Kherson Electrical Machine Building Plant comes to 76.6 percent, at the Altayskiy Motor Vehicle and Tractor Electrical Equipment Plant--69.9 percent, and at the Borisovskiy Automobile and Tractor Electrical Equipment Plant imeni 60th Anniversary of the Great October Revolution--68.2 percent. If we consider individual electrical equipment products for motor vehicles and tractors, then 98.3 percent of the radio antennas produced were of the highest quality category, 71.2 percent of the starters and traction equipment relays, 70.9 percent of the transistorized commutators, 67.4 percent of the magnetos, 63.2 percent of the ignition coils etc.

There is no doubt but that the proportion of the total volume of the marketable products produced by our enterprises, and which are categorized as being of the highest quality, and which proportion (44 percent) was planned for the end of the 11th Five-Year Plan, will be achieved. The service life of electrical equipment for passenger cars will soon increase by an average of 25,000 driving kilometers, for trucks--by 50,000 km, and for buses--by 100,000 km. The specific labor intensiveness of maintenance and repair will drop by 25-30 percent as a result of using maintenance-free assemblies, and by setting up the most effective preventive maintenance schedules.

The expanded production of motor vehicle and tractor electrical equipment for completing sets of equipment and for spare parts, and the continued extension of the service life and the stabilization of the quality of these parts is being accomplished through the introduction of progressive integrated production methods and the mechanization and automation of production, that is, by the technical reequipping of the enterprises, and by improving the organization of labor and the control of production. For example, at the previously mentioned Borisovskiy Automobile and Tractor Electrical Equipment Plant, a manufacturing production line has been set up for producing starter drive bearing races by the cold extrusion method. This production line has helped to raise the coefficient of materials utilization to 0.89, to completely eliminate the assembly and welding of the bearing races from the operation, to save over 300 tons of steel per year, and to make 37 workers available.

NIIavtopriborov has developed a model installation for vacuum application of reflective and protective coverings onto headlight and light reflectors which installation will produce high-quality products. Just such an installation has already been introduced at three plants: the Krasnyy Oktyabr Plant in Kirzhach, OZATE [Ordzhonikidze Motor Vehicle and Tractor Electrical Equipment Plant] in Ordzhonikidze and VZOA [possibly Vyazniki Motor Vehicle Equipment Plant], and has had an economic effect of almost one million rubles. In Pskov's Avtoelektroarmatura [Motor Vehicle Electrical Accessories] Plant, and in conjunction with NIIavtopriborov, an integrated automated robot-equipped production line (model APL-008M) has been set up to assemble small relay type items. The introduction of five such lines has made it possible for the plant to obtain an economic effect of 2,180,000 rubles.

In general, it must be said that in the last few years NIIavtopriborov specialists have been working quite actively in collaboration with specialists of sectorial enterprises. And have not only been working with specialists of their own sector. Thus, in conjuction with NIFKhI [Order of Labor Red Banner Scientific Research and Physico-Chemical Institute imeni L. Ya. Karpov] in Moscow, they have developed a new gas-phase plasmochemical method of applying a protective film onto light reflectors, which markedly improves the corrosion resistance of the reflective coating, and increases the service life of the headlights' optical elements no less than 1.5-fold. The licence for this process has been sold in France; the process is protected by four inventor's certificates and six patents.

Working with GNIIKhTEOS [not further identified], in Moscow, they have developed a new gas-phase method for manufacturing the forming parts of molds, which reduces the labor intensiveness of manufacturing complicated molds, and has provided a substantial saving in tool steel. This development is also protected by inventor's certificates and patents.

The section of the exhibition which was devoted to the development of motor vehicle and tractor electrical equipment and instruments over 60 years showed that this subsector is growing successfully, and is on the cutting edge of scientific and technical progress.

12659
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MOTOR VEHICLES AND HIGHWAYS

FEATURES OF NEW GAZ-24-10 VOLGA SEDAN

Moscow ZA RULEM in Russian No 2, Feb 85 pp 10-11

[Article by V. Reutov, chief of the GAZ Design and Experimental Operations Administration design bureau: "The Renovated Volga", under the rubric "Soviet Technology"]

[Text] At "Avtoprom-84", the anniversary exhibition commemorating the 60-th anniversary since the founding of Soviet motor vehicle construction, the Gorkiy Motor Vehicle Works unveiled its new model, the Volga GAZ-24-10. The GAZ-24, a model well known to all, has undergone a comprehensive modernization, the purpose of which was to raise the vehicle's technical level, by having utilized a number of the design resolutions which were tested and developed on the GAZ-3102 model. These modernized vehicles will occupy the place previously held by the GAZ-24, and the line of models based on it, in the plant's program; the GAZ-3102 will be put into production at the same time (ZA RULEM, No 2, 1981 and No 12, 1982).

Improvements have been made in all the vehicle's basic units.

The GAZ-24-10 engine comes from a new line produced by the Volga Motor Vehicle Works. Its classification number is ZMZ-402.10. Thanks to improved intake and exhaust systems, the new engine is rated at five more horsepower than its predecessor, the ZMZ-24D, even though it has identical displacement and compression ratio. But the main advantages are the improved economy, the reduced toxicity of the exhaust gases and the extended service life. These were achieved by using the new K-151 carburetor, which features the EPKhKh [Forced Idle Economizer], and a system for recirculating exhaust gases.

The engine's basic parts have been strengthened to extend the service life of the ZMZ-4022.10 (GAZ-3102). This includes the block and cylinder sleeves, the crankshafts, camshafts, and other parts. The cylinder sleeves in the new block are secured by an upper flange, which protects them from deformation when the cylinder heads are bolted on. The cooling system and water pump have also been adopted from the ZMZ-4022.10 engine.

Concerning changes in the transmission, we call your attention to the stronger clutch and the rear axle with a 3.9 gear ratio in the final drive, which has been standardized with similar assemblies in the GAZ-3102.

The updated Volga has adopted low-profile steel-belted radial tires from the GAZ-3102. These tires, in addition to having long wear life, also provide some reduction in fuel consumption. The wheel rims had to be widened, and the wheel span increased in order to accept these tires.

Among the undercarriage assemblies, the brake system has undergone the most substantial changes. It has been equipped with a tandem master cylinder. It differs from the Moskvich-2140 cylinder in use at present on the GAZ-3102, in its design and size.

Soon, this new master cylinder is to be installed on the GAZ-24-10 as well as the GAZ-3102. The twin-chambered vacuum booster, the rear brake circuit pressure regulator and the brake system hydraulic drive elements and connections from the GAZ-3102 model are also being used. The use of Neva high-temperature brake fluid has made changes necessary in the brake cylinder design for the front and rear brake drums. The parking brake is now set by a lever located on the floor between the front seats.

The vehicle's electrical equipment has been modernized. In order to supply power to the vehicle's growing number of electrical units, a more powerful (850-watt) model 16.3701 generator, which works in tandem with a new voltage regulator, has been installed. The GAZ-24-10 is one of the first domestically-produced passenger cars to be equipped with a contactless transistorized ignition system. This system should be more stable than regular systems, and should be easier to service.

In the modernization process, a great amount of emphasis was placed on comfort. In this connection, the vehicle interior has undergone a radical alteration.

The car has been equipped with the same seats found in the Volga GAZ-3102, thus providing the driver and passengers with comfortable seating, and preventing fatigue, even after extended trips. In the front seats, in addition to normal adjustments, a "garage" adjustment has been provided, i.e., the seat height can be adjusted (when the vehicle is stationary). The seats are equipped with headrests. The driver and front seat passenger have been provided with inertial safety belts. The styling changes in the vehicle's interior include a reshaped door lining and enlarged arm rests.

The instrument panel is of a radically new design. In contrast to the old panel, which consisted of a metal, polyurethane-lined frame, the new panel is completely cast of high-strength resilient plastic, which lends it a modern look. While meeting all the requirements for safety, the panel is, at the same time, quite a bit lighter, and takes less labor to manufacture. The instrument panel in front of the driver is equipped with a new speedometer, a variety of instruments, and a clock.

The steering wheel even has a new design, in keeping with the overall style of the interior. The turn-indicator lever has been combined with the headlight switch and has been installed to the left and below the steering wheel. A combined switch for the windshield washer and wiper are right of the steering wheel.

The heating and ventilation system has been updated, having been made more efficient through the introduction of a combination of preheated and fresh air. Visibility has been improved by the rear window defroster.

Several changes have also been made in the vehicle's exterior appearance: the doors have new recessed locking handles, the adjustable air verts have been eliminated from the front door glass, and the wheels are decorated with large plastic wheel covers.

Improvements have been made not only in the car's interior, but in the trunk as well. By installing an electric rear window defroster, the space behind the rear seat back, where the rear window blower-defroster was located has been made usable. The spare tire has been put here, giving the trunk more storage space for baggage.

How have the car's indicators been changed as a result of these modernizations?

In the first place, while retaining its former size, it is now more comfortable and safer for the occupants. The mass of the new car is 10 kg less than the GAZ-24. Its top speed has increased, its acceleration performance has been improved and its fuel consumption has decreased.

Second, the fact that its interservice periods have been extended, except for certain lubrication points, has reduced the labor intensiveness of maintenance by 10-15 percent.

Within the GAZ-24-10 line, provision has been made for modernization of all the traditional Volga versions, i.e., taxis, station-wagons, medical vehicles, etc.

Development of the Volga modernization is planned in two stages. At the first stage, in 1985, the new engine, tires and brake system will be introduced. At the second stage, in 1986, the interior is to be renovated and other changes in the body are to be carried out.

SPECIFICATIONS FOR THE GAZ-24-10 VOLGA AUTOMOBILE (DATA IN PARENTHESES PROVIDED FOR PURPOSES OF COMPARISON WITH CONTRASTING PARAMETERS OF THE GAZ-24)

GENERAL INFORMATION: Wheel arrangement--4X2. Number of seating spaces--5. Mass, when fully equipped--1,400 (1,410) kg. Top speed--148 (145) km/hour. Elapsed time, acceleration from 0 to 100 km/hour, with driver and one passenger--18 (20) seconds. DIMENSIONS: Length--4,735 mm. Width--1,800 mm. Height--1,490 (1,495) mm. Wheelbase--2,800 mm. ENGINE: Number of cylinders--4. Displacement--2,445 cm^3. Compression ratio--8.2:1. Power rating--100 (95) horsepower/74 (70) kW at 4,500 r.p.m. Maximum engine torque--18.5 (19) kg(f)·m/182 (186) newtons per meter at 2,400-2,600 (2,200-2,400) r.p.m. Fuel--AI-93 gasoline. TRANSMISSION: Clutch--dry, single-plate. Gearbox--four-speed. Final drive gear ratio--3.9 (4.1). UNDERCARRIAGE: Tires--205/70R14 (7.35--14). BRAKES: Front and rear independently-controlled drum brakes with vacuum (hydraulic-vacuum) booster.

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MOTOR VEHICLES AND HIGHWAYS

FEATURES OF VAZ-2104 STATION WAGON

Moscow ZA RULEM in Russian No 1, Jan 85 pp 16-17

[Article by Yu. D. Papin, plant deputy chief design engineer: "The VAZ-2104 - A New 'All-Purpose' Vehicle"; words in all capital letters rendered in boldface in text]

[Text] In addition to starting up production of the VAZ-2108, a front-wheel drive automobile, the Volga Motor Vehicle Works is systematically working to improve its standard-design vehicles. Prominent among these are models from the VAZ-2105 - VAZ-2107 family. Deputy chief design engineer at the plant, Yu. D. Papin, tells about the latest innovation in this line of vehicles, the VAZ-2104 automobile with the station-wagon body.

The new vehicle is the production program replacement for the VAZ-2102 station wagon, which has served us well. With the production of the VAZ-2104, the family of models whose production began in the 11th Five-Year Plan is getting the addition it requires: a multi-purpose cargo and passenger car. Its characteristic combination of capaciousness, speed, economy and comfort, we believe, will attract many people--those who live in well-kept villages, those who possess subsidiary garden plots, and those who are fond of tourism and other kinds of active recreation.

The VAZ-2104 was developed on the basis of the VAZ-2105 sedan (ZA RULEM, 1980, issues 6, 8, 12; 1981, issues 2, 4) and, consequently, absorbed all the improvements implemented in that model. They are already sufficiently well-known, but it is fitting to recount them here once again. These are, the ENGINE, with a quieter camshaft linkage, by virtue of using a toothed belt rather than chain drive; an "Ozon" type carburetor, which reduces toxicity and improves the vehicle's operating economy; and an air filter with a thermoregulator; the GEAR BOX, in which the gear ratios have been changed; the STEERING MECHANISM has been improved, requiring less effort to turn the steering wheel; the BRAKES have a vacuum booster, and the rear wheels have self-adjusting brakes; steel-belted radial TIRES; and finally, new instruments for the ELECTRICAL EQUIPMENT: specifically, headlights with halogen lamps, which have higher performance characteristics, and their beam may be adjusted to compensate for vehicle load; and a warning light system, conveniently situated under the hood.

The seating, instrument panel, heating and ventilation system installed in the vehicle have not only modernized the interior, they have also made it much more comfortable in comparison with the VAZ-2102. The adoption of these design solutions has given the new station wagon more sales appeal. And the cargo capacity has increased by 25 kg. This was made possible by the installation of a more powerful engine in the VAZ-2105 than in the VAZ-2102. That portion of the vehicles intended primarily for foreign purchasers will be equipped with the VAZ-2103 motor (1,458 cc, at 77 hp/ 57 kWt). This model is designated the VAZ-21043.

Certain new components and design solutions are characteristic for only the VAZ-2104 station wagen and are associated with the specific features of the vehicle. It has new tail lights, which are different from that of the VAZ-2105. Each of them is equipped with large headlights, a stop signal and foglights with a red diffuser, turn signals, backup lights, and a reflector (katafot [unknown]). There is a separate lamp with two bulbs for illuminating the license plates.

For the first time, standard equipment for the station wagon includes windshield wipers and a washer with an electric pump for the rear window. They are controlled by a three-position switch on the instrument panel (on the VAZ-2105 automobile this spot is covered with a plug). When a certain amount of pressure is applied to the button the windshield wipers come on, and when pressed again, the washer is activated. For this purpose, the button is not in a fixed position; the washer pump operates only while the pressure is applied. The washer tank is situation on the right side in the baggage compartment. The capacity of the tank is about two liters.

The rear window is higher than on the model 2102, and has an electric heating element. This, along with the two outside mirrors which can be adjusted from inside, has made things more convenient for the driver, has improved his field of vision and, consequently, has made the vehicle safer.

A button has been installed on the instrument panel for turning on the rear window defogger, as on the VAZ-2105.

Naturally, the circuitry for the electrical equipment differs somewhat from the VAZ-2105 circuitry because of the new and modified instruments which have been introduced. A larger capacity fuel tank has been installed under the floorboard in the rear (45 ltrs as opposed to 39 in the sedan); the spout of the fuel tank leads to the left rear fender. The spare wheel, a toolbox and a jack are also situated under the floorboard in a special compartment.

Those for whom even the station wagon's capacious cargo section is not large enough may mount a luggage rack on the roof (provided the total weight of the load and the rack does not exceed 50 kg); they can also tow a trailer.

Technical Characteristics of the VAZ-2104 Automobile
(Figures in parentheses pertain to the VAZ-21043 modification)

General information: number of doors - 5; seating capacity - 5; loaded weight - 1,020 kg; permissible load with five passengers - 80 kg; with driver and one passenger - 305 kg; total weight for towed trailer equipped with brakes - 750 kg; not equipped with brakes - 300 kg; maximum speed with full load - 135 (143) km/h; time to reach 100 km/h from full stop with driver and one passenger - 18.5 (17) sec; fuel consumption at speeds of 90, 120 km/h and in city driving - 7.5; 10.2 (10.4) and 10.2 (10.5) ltrs/100 km; fuel capacity - 45 liters. Dimensions: length - 4,115 mm; width - 1,620 mm; height - 1,443 mm; wheel base - 2,424 mm; wheel track: front - 1,365 mm; rear - 1,321 mm. Tires - 165/80SR13. Engine: Model - VAZ-2105 (VAZ-2103); number of cylinders - 4; engine capacity - 1,294 (1,458) cc; compression - 8.5; horsepower - 69 (77) hp/51 (57) kWt at 5,600 rpms; valve mechanism - ONS [unknown]; linkage - toothed belt (chain). Transmission: clutch - dry, single-disk; gear box - four-stage: I - 3.67; II - 2.10; III - 1.36; IV - 1.0; reverse gear - 3.53; gear ratio - 4.3 or 4.1 (4.1 or 3.9). Suspension: independent front suspension, with parallel arms and springs; rear wheels - dependent, springs with transverse and longitudinal bars. Steering control: shockproof construction with intermediate universal joint; steering mechanism - with cone drive worm gear on ball bearings. Brakes: hydraulic with vacuum booster; front disk brakes, rear drum brakes.

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MOTOR VEHICLES AND HIGHWAYS

FEATURES OF NEW VOSKHOD-ZM-TURIST MOTORCYCLE

Moscow ZA RULEM in Russian No 2, Feb 85 p 11

[Article by Yu. Danilov, chief of the special design bureau and L. Khudyakov, chief of design bureau: "The 'Voskhod' for Touring Riders"]

[Text] Production of the Voskhod--ZM-Turist cycle has begun in the Kovrov plant. Designed after the Voskhod-ZM all-purpose model (see ZA RULEM, No 3, 1984), it is primarily for those who enjoy motorcyle-touring.

This is the first time in its practice that the plant has designed a machine for a particular sector of consumers. Certain changes have been made in the cycle's design, and additional accessories have been developed in order to satisfy the needs of motorcyclists making trips of several days.

The Voskhod--ZM-Turist cycle is equipped with sports-type handlebars and a reinforced crosspiece, which enhances the cycle's structural rigidity, and thus its reliability in difficult road conditions.

The handlebars can be adjusted to a wide variety of positions: each rider can set the handlebars to suit his own comfort when seated, thus lessening the threat of fatigue. The new Voskhod is also equipped with crash bars and double rear-view mirrors.

Veteran touring cyclists know how much trouble it is to mount baggage onto a motorcycle. We have tried to reduce these problems to a minimum on this new model by equipping it with carriers: two on the sides and one on the rear, and with bags made of artificial vinyl leather. The bags are secured to the side-mounted carriers with special belts. A touring rider can pack everything he needs for a trip of several days in these bags: his food supply, clothing and shoes. The bags are designed for use off the motorcycle as well.

The map-case, which is attached to the fuel tank, is unique. It is designed for the small items which need to be kept handy. There is a pocket covered with transparent film on the front of the map-case. Maps, route diagrams, or other documents can be inserted here. The side-mounted bags give the motorcycle an additional sporty note: this is really an indispensable piece of motorcycling gear for cycling competitions lasting several days.

The new decals on the tank and instrument housing covers--lavsan film decals--have also become distinctive features of the Voskhod--ZM-Turist.

It should be said that the interests of touring cyclists have been catered to in great part in the design of the base model Voskhod-ZM motorcycle: its 12-volt electrical system, with its powerful lights and bright turn indicators permit confident driving after dark. The alternating-current generator with its electronic voltage regulator have eliminated the problems touring cyclists on other motorcycles often used to have with the storage battery (electrolyte boiling out, undercharging while driving with all the lights on, etc.). The contactless ignition system insures easy starting and stable engine operation and requires no adjustment.

One would expect that this combination of excellent designs, which have given good account of themselves, and handy accessories, will make this new motorcycle popular among touring cyclists. Information on customer demand will help make a more accurate determination of needed production volumes of this motorcycle.

BRIEF SET OF SPECIFICATIONS FOR THE VOSKHOD--ZM-TURIST MOTORCYCLE

GENERAL INFORMATION: Dry (unfueled) mass--125 kg. Maximum load--150 kg. Top speed--105 km/hour. Braking distance, from 60 km/hour--no more than 20 meters. Monitored fuel consumption--4.4 liters @ 100 km. Fuel capacity--14 liters. MOTOR: Two-stroke, single-cylinder, air-cooled. Displacement--173.7 cm^3. Compression ratio--9.5:1. Power rating--14 h.p./10 kW at 5,500-5,800 r.p.m. Fuel--Mixture of AI-93 or A-76 gasoline with oil (25:1). Ignition system--electronic, contactless. ELECTRICAL EQUIPMENT: Voltage--12V. RUNNING GEAR: Wheels--Interchangeable. Tires--3.25--16.

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FEATURES OF NEW IZh-YUPITER 5, 5K MOTORCYCLES

Moscow ZA RULEM in Russian No 1, Jan 85 pp 10-11

[Article by M. Perepelitsa, an engineer at Izhmash in Izhevsk: "Yupiter's Fifth Start"]

[Text] New IZh-Yupiter-5 and Izh-Yupiter-5K motorcycles have started to roll off the assembly line at the Izhmash Association. (The branch standard classifications for these models are Izh-6.113 and Izh-6.114). In the process of developing these motorcycles the designers tried to give maximum consideration to the comments and desires expressed by the owners of fourth-generation "Yupiters". For the most part these pertained to the electrical equipment, economy, and the engine's ability to adapt to changing operating conditions.

The engine on the Yupiter-5 has been modernized from the ground up. The dynamic-traction qualities of the machine have been increased by selection of the most advantageous phases of valve timing, and improved cylinder exhaust. Most pleasing of all is the fact that the so-called adaptability index has increased; this describes the ability of the engine to maintain rpm's when there is an increase in resistance to motion--also known as operating flexibility. This is especially important when traveling with the sidecar on dirt roads, or cross country.

What do the new engine features look like in comparison with the previous ones? According to the charts, the maximum torque has increased from 3.4 to 3.5 kg/m, whereas the revolutions at which it is achieved have decreased by 600-900 rpms. Minimum steady revolutions have also decreased to 1,300 rpms. The power curve (the external characteristics) of the engine has also changed for the better. By sacrificing four hp at maximum power (24 as opposed to 28 hp for the Yupiter-4), they have managed to increase by 1-2 hp the power developed at the medium and most often used rpms. The revs at maximum power have also decreased to 4,800-5,600 rpms (whereas for the "4" it is 5,600-6,200 rpms).

The figures and the charts represent real benefits to the motorcycle owner. Now, even with a full load, it accelerates easily and operates reliably in the higher gears; therefore one has to shift gears much less often than for the "Yupiter-4". One would think that both rural and urban motorcyclists will appreciate this quality.

Fuel consumption has also decreased: the specifications are--5.9 ltrs/100 km as opposed to 6.2 for the motorcycle itself; and 7.1 as opposed to 7.5 ltrs/100 km for a motorcycle with sidecar attached.

A new design for the air cooling fins on the heads and cylinders helps cut down on engine noise.

Aside from improving the operating characteristics, attention was devoted to increasing engine reliability: piston rings have increased wear-resistance; the seal on the crankcase housing was improved; and, the kick-starter and the gear mechanism on the clutch drum have been improved. Strengthened exhaust pipe mountings at the cylinders have provided a better air-tight connection, and have made it easier to disconnect these parts for repairs.

There are numerous changes in the design and technology of manufacturing parts and components for the operator's convenience. Among these are flexible grips on the handlebars, dual cams on the front brakes, and additional compression rings on the rear shocks. A forged bracket has been added to the front mudguard; a relief design has been added to the saddle, the upholstery for which is connected to the base without rivets.

The electrical equipment on the Yupiter-5 is basically the same as on the previous models; however the plan and the design of the instruments have been improved significantly. Thanks to this, the engine is easier to start, the ignition system has improved operating reliability, and battery charging is more stable. Even owners of Yupiter-4's built in 1984 appreciate the better starting qualities--which obtain even under unfavorable conditions: after driving with the lights on, or when the battery has a weak charge. These advantages have been achieved through increased spark-formation capacity owing to the use of heavier-gage wire in the coil windings. A stable spark is provided at the spark plug with a voltage of 7.3 to 8 v when cold, and 9.5-9.7 v when hot.

In order to reduce losses at electrical connections, the circuitry has been changed for connecting the ignition coil and the emergency engine starter. The coils have been connected directly with the ignition lock, and the plug connectors have been removed from the circuit. The emergency switch has been eliminated from the coil circuit, and its circuitry changed: its normal position is in the off condition, which suits its purpose better. When it becomes necessary to stop the engine in an emergency, the ignition circuit is now not interrupted, and the circuit to the "mass" of the breaker coils is closed. It goes without saying, that the emergency switch should be used only in extreme situations.

There is yet another innovation--a strong spring-loaded button has been provided for switching off a significant portion of the electrical energy consumption and switching devices. It should be used when the battery is almost totally discharged, and the ordinary means of starting the engine is difficult or impossible. In such a situation, in order to start the engine, after pressing the button one must make a hookup directly to the generator winding, from any source of current (even from a pocket flashlight battery).

The number of plug connections has been reduced in the circuits connecting the battery and the BPV 14-10 rectifier-voltage regulator. This has had a favorable effect on th operation of the generator system and has increased stability of the battery charge. The design of the BPV 14-10 has itself been changed: an additional (duplicate) terminal has been added to the generator's third phase. Along with the other improvements in the circuits and parameters of the component this measure also provides for increased reliability.

Improved switches for the turn indicators and ("day-night") lighting have been employed on the "IZh-Yupiter-5". Their contact groups have been made stronger, and the mechanism itself stays in the selected position better.

In addition, the rough-road performance of the new motorcycle will be improved. This includes a spring-mounted front panel; a spare wheel, mounted between the machine and the side attachment; the tire on the wheel will have improved rough-road performance (with an increased number of ground lugs). For traveling on dirt roads or even right across rough terrain, the motorcyclist can mount the spare rather than the standard drive wheel. Rural workers rightfully give this variant the highest rating. But But it is also convenient for those who love to travel, for hunters, and for mushroom pickers. Designed primarily for this group of users is a multipurpose sidecar of new design, developed for the "IZh-Yupiter-5K" by the Vyatskiye Polyany Machine-Building Plant. It can be quickly converted from the passenger to the freight mode, with a 120-kg capacity. A folding cowling and cover for the luggage compartment make the sidecar more convenient.

Technical Characteristics of the IZh-6.113 ["IZh-Yupiter-5"]
(Parentheses--differing data for the variant IZh-6.114-"IZh-Yupiter-5K")

General information: empty weight - 160 (255) kg; maximum load - 150 (265) kg; top speed - 125 (95) km/h; acceleration time on a 400-meter course - 21 (27) sec; braking distance at a speed of 60 km/h - no more than 23 (25) meters; specified fuel consuption - 5.9 (7.1) ltrs/100 km; fuel capacity - 17 ltrs. Dimensons: Length - 2,170 (2,200) mm; width - 810 (1,700) mm; height - 1,170 (1,300) mm; wheelbase - 1,450 mm; road clearance - 135 (125) mm. Engine: two-cycle, twin-cylinder, air-cooled; displacement volume - 348 cc; cylinder diameter - 62 mm; piston stroke - 57.6 mm; compression - 9.3; power - 24 hp/18 kWt at 4,800-5,600 rpms; fuel - oil mixed with AI-93 or A-76 gasoline (25:1 ratio). Electrical equipment: voltage - 12v, with an AC alternater and an electronic rectifier-voltage regulator. Transmission: multiplate clutching in an oil bath; transmission gear box - four-stage (I - 3.17; II - 1.81; III - 1.26; IV - 1.0); forward gear - chain: 2.57; reverse gear - chain: 2.22. Running gear: frame - tubular, welded; front fork - telescoping; rear support - pendulum, with regulating springs and hydraulic shock absorbers; wheel mounting - front: no less than 155 mm; rear - no less than 90 mm.

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MOTOR VEHICLES AND HIGHWAYS

BRIEFS

LVOV LNG FILLING STATION NETWORK--Lvov (TASS), 3 Feb--A new LNG filling station began to operate today in Lvov. With its entry into operation, the creation of a city-wide network of motor transport refueling points for this economical and ecologically clean fuel has been completed. The traffic capacity of the station is 500 vehicles per day. An automatic system monitors gas distribution and its pressure regulation. This ensures the efficient operation of the equipment with a minimum number of service personnel. The transition to compressed gas on a wide scale is taking root in the motor vehicle enterprises of the oblast. This year the Lvov Truck Transport Administration will receive more than 400 sets of equipment allowing the changeover of the machinery to this form of fuel. [Text] [Moscow PRAVDA in Russian 4 Feb 85 p 1] 12821

COLD-WEATHER STARTER DESIGNED--Novgorod--The first batch of E-312 units for starting motor vehicle engines in the cold period of the year has been developed and produced at the experimental-test plant of the Avtospetsoborudovaniye Association. The new product, in contrast to the prior E-307 model, is easier to produce and more reliable in operation. The electrical part is here apportioned in a single block, which considerably simplifies the assembly, installation and operation of the unit. The dimensions and weight of production have been decreased, which will provide a considerable savings of metal in series production. Plant designers N. Komarov and N. Filippov are the developers of the innovation. [By SOTSIALISTICHESKAYA INDUSTRIYA correspondent V. Proskura] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 12 Feb 85 p 2] 12821

KURSK LNG FILLING STATIONS--Kursk--The construction of two motor vehicle LNG filling stations has begun in Kursk. Each of them is designed for the refueling of 500 motor vehicles a day. Dozens of motor vehicles in the city are already gasified. In the Kurskgaz Trust, approximately 60 motor vehicles have been reequipped, which allowed a savings of 200 tons of gasoline in the past year. Motorists followed the example of the gas workers: 15 gas-cylinder motor vehicles already operate in the Second Motor Freight Transport Enterprise. The startup of gas distribution stations will allow an increase in the number of vehicles that operate on this inexpensive and ecologically much cleaner fuel. [By Yu. Petrov] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 14 Feb 85 p 2] 12821

ELECTRICALLY POWERED RAF VANS--Riga--Where does one not encounter the nimble, maneuverable microbus of the Riga Bus Works [RAF] on the roads of our country? It is multifaceted and ubiquitous--ambulance and route taxi, technical service van and shop van. This "Rafik" here, a route taxi coursing the streets of Moscow, is no different in appearance from its fellows. It is, however, an electric bus. Experimental batches of these vehicles were turned out by the RAF plant on the model of the series-produced microbuses. The first tests of the Riga electric buses took place at Olympiad-80, where on the order of the Olympic Organizing Committee the first seven electric vehicles were produced. Now newer, more advanced models are turned out. Fifty-two electric buses serve as Moscow route taxis. Ordinary lead-acid batteries are the current source in the electric buses. They provide for vehicle mileage of up to 42 kilometers within city limits, and 68 kilometers on rural roads without recharging. The top speed is 60 kph., but for a route taxi more is not required. The plant designers are carrying out combined research with the Moscow Kvant Scientific Research Association. By the joint efforts of the Riga and Moscow designers, a model of an electric bus was developed that will operate on an electro-chemical generator that can turn chemical energy into electrical energy. [By I. Rumova] [Text] [Moscow TRUD in Russian 20 Feb 85 p 3] 12821

REFRIGERATED TRAILERS FROM KRASNOYARSK--Krasnoyarsk--The assimilation of a new form of production has begun at the Krasnoyarsk Motor Vehicle and Tractor Trailer Works, a satellite of the Kama Motor Vehicle Works. Capacity for the production of refrigerated semitrailers was introduced here recently. The first models of the refrigerators on wheels are already undergoing testing by motorists, and by the end of the year more than 100 of them will be supplied to the national economy. [By Yu. Vakhrin] [Text] [Moscow GUDOK in Russian 27 Mar 85 p 2] 12821

SARATOV BYPASS HIGHWAY CONSTRUCTION--Saratov, 2 Apr--A new motor vehicle bypass highway is being constructed here, which will run from north to south from 1 to 3.5 kilometers from the prospective boundary of the oblast center. The ring bypass is a little more than 34 kilometers in length. With its introduction, the flow of vehicles in Saratov will be decreased, and a reliable connection will be provided between the city's Leninskiy and Zavodskiy industrial districts. The savings in transport expenditures alone will total approximately five million rubles a year. With the creation of this bypass, the possibility has appeared to begin the design of a highway bridge over the Volga at the village of Pristannyy. All of this will allow the creation of a more rational transport network for the two major Volga neighbor cities of Saratov and Engels. [By PRAVDA correspondent A. Vorotnikov] [Text] [Moscow PRAVDA in Russian 3 Apr 85 p 3] 12821

CSO: 1829/211

RAIL SYSTEMS

RAILWAYS PERFORMANCE STATISTICS FOR 1985 1ST QUARTER

Moscow GUDOK in Russian 23 Apr 85 p 3

[Unsigned article: "To Increase the Pace of Shipments; Review of Transport Operations for the 1st Quarter of 1985"]

[Text] The beginning of this year was very difficult for transport. The harsh winter brought many surprises. But, the fact was that equipment and personnel were poorly prepared for the extreme cold and snowstorms. And while many railroad workers labored selflessly, the tasks for overall shipments and for shipments of most key freights were not fulfilled.

The shortfalls in shipments were: oil, over 2.9 million tons; iron and manganese ore, 5.5 million tons; timber products, about 7 million tons and chemical and mineral fertilizers, over 3.9 million tons.

The plans were fulfilled for 17 types of freight. Above-plan shipments were: grain, 337,000 tons; chemicals and soda, 381,000 tons; meat and animal oil, 132,000 tons; cotton, 194,000 tons; sugar beets and seeds, 767,000 tons; potatoes, vegetables and fruits, 60,000 tons and other foodstuffs, 5,000 carloads. Shipments of agricultural machinery, motor vehicles, machinery and equipment and small metal products and fasteners were well above plan.

The railroads' total volume of shipments for the first quarter was 898 million tons. This was 7.2 percent less than planned. The main shortfall occurred in February. Four railroads fulfilled their plan for tonnage of total shipments: the Azerbaijan, which loaded 189,000 tons above plan; the Central Asian, 108,000 tons above plan; the West Siberian, 90,000 tons above plan and the Far Eastern, 432,000 tons above plan.

Despite large freight-loading reserves, many railroads performed below their abilities, negatively affecting the system's overall performance. The following railroads had shipment shortfalls: Donetsk, 8.2 million tons; Dnepr, 7.3 million tons; South Urals, 4 million tons; Kuybyshev, 3.8 million tons; Southeastern, 4.1 million tons and Northern, 3.6 million tons.

The situation with fuel shipments was especially alarming. Nearly all the main coal-hauling railroads did not meet their plans for bituminous-coal

loadings. The biggest shortfalls were by the Kemerovo Railroad, 3.5 million tons, and the Donetsk Railroad, 3.1 million tons.

The Kuybyshev Railroad, while having sufficient loading capacity and enough tank cars, had a shortfall in bulk-oil shipments of 2.5 million tons. Other railroads with shortfalls in bulk-oil shipments were: Volga, 513,000 tons; Southeastern, 425,000 tons; Northern, 373,000 tons and Gorkiy, 269,000 tons.

There were also large shortfalls for other types of freight. For iron and manganese ore, the Dnepr Railroad had a shortfall of 3.1 million tons; the Southern, 973,000 tons and the Tselin, 431,000 tons. The Northern Railroad had a particularly large shortfall in timber products shipments (2.4 million tons), while the Gorkiy and Sverdlovsk Railroads had shortfalls of 1 million tons each and the East Siberia Railroad had a shortfall of 936,000 tons.

Express Shipments. The level of shipments by shippers' express trains was higher than in the first quarter of 1984 for 13 railroads, including more than 2 percent higher for the Krasnoyarsk, Transbaykal, Gorkiy and Baykal-Amur Railroads. However, for most bulk freights, the system-wide share of express-train shipments fell.

Static Load. System-wide, the task for average static load was exceeded by 200 kg. There was an increase of 220 kg over the same period last year, which permitted an additional 3.7 million tons of freight to be carried without any additional railcars. The static loads for most types of bulk freight increased.

Eighteen railroads met their tasks for this important qualitative indicator. The October [Leningrad], Baltic, Northern, Donetsk, North Caucasus, Azerbaijan, Transcaucasus, Tselin, Kemerovo, East Siberian and Far Eastern Railroads fulfilled their norms consistently over the three-month period.

The collectives of 19 railroads increased their static loads over the first quarter of last year. The Azerbaijan Railroad had the greatest increase: 1,130 kg. Other railroads had the following increases (in kg): Tselin and Far Eastern, 1,120 each; October, 1,100; Transcaucasus, 950; Northern, 830; Baltic, 680; Kemerovo, 490; East Siberian, 440 and Alma-Ata, 410.

Meanwhile, 13 railroads had lower static loads than last year. The greatest reductions were 710 kg for the Volga Railroad and 490 kg for the West Siberian Railroad.

Freight turnover totaled 849 billion tariff ton-km. The plan was underfulfilled by 7 percent. The freight turnover was 5.5 percent lower than for the same period last year. The average shipment distance increased by 3 km. This indicator increased for grains, refractories and granulated slags, mineral fertilizers, ferrous metals, cement, peat (for

industrial use as a raw material) and structural goods. Meanwhile, the shipment distances for bituminous coal, coke, oil, non-ferrous and sulfur ores, timber products, structural steel, and mixed feed decreased.

Passenger turnover totaled 72 billion passenger-km. This was only a 0.1 percent increase over the same period last year. The plan was underfulfilled by 1.4 billion passenger-km.

The metros overfulfilled their passenger hauling plan by 1.7 percent. They transported over 1.108 billion passengers over the three months. The cost of providing a metro trip was reduced by 2.4 percent. Labor productivity increased by 3.4 percent.

Difficulties in railroad operations cannot help but have an effect on qualtitative indicators.

The passenger-train departure schedule was 95.8 percent fulfilled, while the travel-time schedule was 91.7 percent fulfilled. These indicators are 2.9 and 4.6 percent, respectively, below those of the same period last year. The greatest disruptions were on the Volga, Southeastern, Kuybyshev, Sverdlovsk and Gorkiy Railroads.

Overall, the rail system's freight-train travel-time schedule was 71.1 percent fulfilled. Traffic on the October, Lvov, Southern, Tselin, South Urals, Transbaykal and Far Eastern Railroads was better organized than last year.

Only the October, Azerbaijan, East Siberian, Transbaykal and Far Eastern Railroads accelerated their freight-car turnover. Empty freight-car haulage was reduced on sixteen railroads and system-wide.

The average weight of a freight train was 2,988 tons, an increase of 52 tons over the same period last year. The average weight of electric trains increased by 67 tons to 3,157 tons, while that of diesel trains increased by 28 tons to 2,771 tons. The train weight increased on 26 railroads, including increases of: 136 tons on the East Siberian; 117 tons on the Transbaykal; 109 tons on the Far Eastern; 108 tons on the October; 97 on the North Caucasus and 90 tons on the Krasnoyarsk.

The slowdown in freight-car flow had a negative effect on the locomotive and freight-car utilization indexes. The average daily locomotive productivity was 48,000 ton-km lower than for the same period last year. Only the October, Far Eastern and Baykal-Amur Railroads fulfilled their plan for this indicator. Freight-car productivity system-wide was 9.6 percent below the plan task.

Capital Construction. This year's plan provided for a maximum concentration of labor, material and financial resources on projects under construction, in order to put them into operation as soon as possible.

Great attention was given to renovating and re-equipping existing enterprises and social and service facilities. The level of capital-investment limit utilization was higher than for the same period last year for the construction of: second tracks, electrification and power facilities, passenger facilities, traffic facilities, signalization and communications and residential housing. The situation was worse in the railcar, track and several other departments.

The Moscow, Central Asian, Belorussian, North Caucasus, South Urals and Alma-Ata Railroads were the best at putting resources into operation. Meanwhile, the Moldavian, Transbaykal, Kemerovo, Krasnoyarsk, Far Eastern and a number of other railroads used only 11-14 percent of their annual limit. For the Ministry of Railways as a whole, the limit for construction-installation work was underutilized by 1.7 percent, mainly because of the railroads' construction organizations. The limit was greatly overfulfilled for construction work on the Baykal-Amur Main Line.

The industrial enterprises of the railway sector overfulfilled their product sales plan by 0.8 percent. The Main Administration for the Repair of Rolling Stock and the Production of Spare Parts sold 4.7 million rubles worth of products above plan. The enterprises of the railroads did not meet their plan, fulfilling it by 99.4 percent. Overall, the volume of product sales was 600.9 million rubles, which is 3.1 percent more than for the same period in 1984.

The plan tasks for certain types of rolling-stock repair and for many types of spare-parts production were not fulfilled. For instance, freight-car capital repairs was only 90.1 percent of plan. In-plant passenger-car repairs were only 92 percent of plan.

Despite a reduction in the workforce, the reduction in the volume of production prevented most railroads from realizing their tasks for labor productivity.

It is now important to thoroughly and critically analyze the performance results for the past quarter. Decisive measures must be taken to meet schedules and to ensure that all enterprises and subdivisions fulfill their plan tasks and socialist obligations.

12595
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RAIL SYSTEMS

RAILWAYS MINISTER ON IMPORTANCE OF AMURO-YAKUTSK RR

Moscow IZVESTIYA in Russian 20 Mar 85 p 2

[Interview with USSR Minister of Railways Nikolay Semenovich Konarev, by IZVESTIYA special correspondent Yu. Grin'ko: "A Thrust to the North," date and place not specified]

> [Text] As recently reported, proposals were approved at a meeting of the Politburo of the CPSU Central Committee for the building of a railroad line in 1985-95, joining the BAM with the city of Yakutsk. Minister of Railways N. S. Konarev relates to an IZVESTIYA correspondent how the future line to the country's diamond capital is seen, and what must be done to build the new mainline.

Konarev: The drawing region of the future line is an enormous territory with an area of more than three million square kilometers. It is exceedingly rich in raw natural resources. As is well known, the production of gold, diamonds and complex ores goes on there already. Considerable deposits of coal, iron, apatite, oil and gas have been discovered. Timber reserves are great. How will these resources be placed at the service of the national economy without a sufficiently developed transportation system available?

Today it is based mainly upon river transport. The shallow depth of the upper section of the Lena and the short navigation periods restrain the development of the republic's productive forces. It is enough to say that the average annual cargo delivery shortfall in relation to the declared volume totals approximately 300,000 tons. It is necessary to use aircraft and motor vehicles ever more often, and that, as you realize, is exceedingly expensive.

Correspondent: In other words, every year a mass of goods valued at up to two billion rubles is "frozen" due to the seasonality of access to the material resources.

Konarev: True. And this sum is fully comparable to the construction cost of the Berkakit-Yakutsk rail line.

Included in the Basic Directions of Social and Economic Development of the USSR in the Years 1981 to 1985 and for the Period up to 1990, adopted by the 26th CPSU Congress, was the development of the technical and economic basis of the

new mainline. Three years ago, Mosgiprotrans [Moscow State Planning and Surveying Institute of the State Industrial Committee for Transportation Construction] carried out this work at the request of our ministry. And the workforce of the Mostostroy-10 Trust has already begun laying the new line.

Correspondent: And what is the line's projected freight load?

Konarev: The calculated freight flow in the direction of Yakutsk by the year 2000 will total from 10.4 to 6.3 million tons on the Berkakit-Tommot section (380 kilometers) and 5.9 million tons a year on the Tommot-Yakutsk section (450 kms.).

Correspondent: And in the other direction?

Konarev: Yakutsk to Tommot will be 0.5 million tons, Tommot to Berkakit from 1.1 million at the beginning of the section up to 22.2 million tons a year on the approaches to Berkakit.

Correspondent: The volumes of freight shipped on the northern part of the line do not seem great...

Konarev: At first. Later they will inevitably increase with the industrial assimilation of already known deposits of useful minerals and the discovery of new ones. The traffic rate will be between 34 and 13 pairs of trains a day after the completion of the construction, with a gradual reduction from Berkakit to Tommot. Passenger traffic--two pairs of trains--is included in their number as well.

Correspondent: Nikolay Semenovich, how will the new line be supported and operated?

Konarev: It has been decided to use a duty-watch method. Four permanent settlements will be built with living quarters of the highest comfort--from the calculations, with 13.5 square meters of total area per person. Duty-watch stations will be two joined living and working accomodations. With independent heating, water supply and cleaning structures.

Correspondent: Will the operational complement be large?

Konarev: It will comprise approximately 2,100 people. From the calculations, six men per kilometer of track.

Correspondent: And now how about the new railroad mainline's efficiency...

Konarev: It is formulated above all to allow the more economical assimilation of the growing shipments in service to the central and northern regions of Yakutia, as well as Khatanga and the Northeast. The replacement of motor vehicle shipments by railroad, and the lowering of transport expenses owing to the decrease of freight shipment distance, will allow construction cost payback of the Berkakit-Tommot section in three or four years after the beginning of permanent operation.

Correspondent: In short, it's worth it?

Konarev: Obviously.

12821
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RAIL SYSTEMS

RAILWAYS MINISTRY ACTS TO IMPROVE SUPPORT OF AGRICULTURE

Moscow GUDOK in Russian 11 Apr 85 p 1

[Article by N. Filin, chief of the Agricultural Freight Department, Tselin Railroad, Ministry of Railways: "Freight for the Village--On Time"]

[Text] With each spring day, more and more freight of various types is shipped to the country's agro-industrial complex. These shipments require a steady supply of freight cars, tank cars and containers. The Ministry of Railways has developed a special plan of organizational-technical measures to fully prepare the railroads not only for shipments of goods needed for planting, but also for massive shipments of agricultural products from the 1985 harvest. Operating groups have been organized within the ministry's central apparatus and within the railroads to monitor shipments of grain, mineral fertilizers, agricultural machinery and other machine-building products destined for agriculture.

Special attention is being given to seed shipments. Seed shipment orders and shipping dates are monitored every five days in a joint program with the USSR Ministry of Procurement. By 1 April, 2.278 million tons of seed grain had been shipped, which is 275,000 tons more than for the same period last year. All grain shipments are made upon receipt of the grain from the consignor.

The situation is worse with shipments of petroleum products for agriculture. While diesel-fuel shipments are ahead of the plan, the shipments of other petroleum products are behind schedule. This is due to two factors: the consignors have not presented sufficient quantities for shipment and the kolkhozes and sovkhozes have not taken enough gasoline from the bases of oil-supply organizations.

One of the most important problems to be solved by the railroad workers is to ensure shipments of mineral fertilizers. Because of the bad weather in January and February, a drop in railcar unloadings on a number of railroads and operations problems, the fertilizer-supply task was not fulfilled. The following organizations did not receive a sufficient supply of railcars for product shipments: Apatit Production Association; Azot Production Association in Novgorod; Beloruskaliy and Sil'vinit Production Associations; Sudogda Mine Administration; Stebnik Potassium Plant and several others.

In March, the average daily shipments of mineral fertilizers increased by 488 railcars; this higher level is being maintained. The following organizations are receiving the full planned amount of railcars: Minudobreniya Production Association in Voskresensk; Azot Production Associations in Severodonetsk, Dneprodzherzhinsk and Nevinnomyssk and many other enterprises.

Fertilizer loadings could be much higher if the producing enterprises made fuller and more timely use of rolling stock. In March, the shippers caused a shortfall of 9,600 railcars in planned shipments. Beloruskaliy; Dolomite in Vitebsk; Cherepovets Nitrogen Fertilizer Plant; Vinnitsa, Krasnodarsk, Rossosh, Meleuz and Balakovo Chemical Plants and a number of others made extremely poor use of their railcars. These enterprises missed loading deadlines for 2,500 railcars, which could have carried about 160,000 tons of fertilizer.

In the first quarter, the plans for supplying agricultural motor vehicles, fertilizer spreaders, grain combines and balers were fulfilled. The plans for supplying tractors and other agricultural machinery were not fulfilled.

Railroad executives were sent to the main loading stations to improve the supply of railcars for agricultural machinery and motor vehicles. These measures produced positive results. Up to 12 March, the plan for loading agricultural machinery was 96 percent fulfilled. Shipments increased for the period 12 through 31 March, erasing the previous deficit and overfulfilling the monthly plan by 6.4 percent.

Meanwhile, a number of plants did not present their full quotas of products for shipment. In March, shortfalls in railcar loadings of agricultural machinery were as follows: enterprises of the Ministry of the Automotive Industry, over 2,500 railcars; Ministry of Tractor and Agricultural Machine Building, over 1,200 railcars and Ministry of Machine Building for Animal Husbandry and Fodder Production, over 500 railcars.

12595
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RAIL SYSTEMS

NEW CHIEF TAKES ON OCTOBER RAILROAD PROBLEMS

PM051434 Moscow IZVESTIYA in Russian 2, 3, 4 Apr 85

[2 Apr 85 p 3]

[Part 1 of article by IZVESTIYA special correspondents A. Druzenko and A. Yezhelev under the rubric "The Personnel Question": "Day of Arrival. Letters from the October Railroad"; first five paragraphs are editorial introduction]

[Text] Today we inaugurate a rubric whose materials will, we hope, attract readers' attention.

How many things personnel resolve in current economic life, and not just economic life! The very machinery of our management undoubtedly needs improvement, and improvements and reforms in the organization of the economy are undoubtedly urgent, but it is precisely because of this that a certain natural law makes itself clearly felt: new things require a new approach and personnel backup.

It is no coincidence that this word--"personnel"--is heard so frequently today. To enhance exactingness toward them and increase the return on them--these are the chief tasks which the party resolutely and consistently advances. There is principled talk today of the responsibility of workers employed in management, there competence, not only their professional reliability but also their moral qualities, and, finally, of work with them as a targeted personnel policy.

This demand is being heard increasingly insistently here: however painful this might be for some people, it is necessary to remove from his job a leader who fails to cope with the work assigned or, to put it bluntly, who makes a mess of it, and replace him with someone who is equal to modern standards and the scale of tasks.

Businesslike efficiency is the most important demand of life today, and it is becoming the determining guideline in work with personnel. It is a question here of businesslike efficiency understood in the wide sense--as the organic combination of the worker's political, professional and moral qualities.

Leningrad--A year ago an old steam locomotive engineer from Dno Station set out on a journey with the intention of visiting relatives in Zaporozhye, Volkhov and Leningrad. The trip so astounded him with the lateness of trains and, chiefly, the lack of order on his own October Railroad, where he had worked for more than 40 years, that on returning home the veteran engineer took to his bed, as he wrote the editorial office, "as the result of an unbearable cardiac disorder."

Perhaps some people might think that the old man, fatigued by long journeys, was laying it on a bit thick. But no, that was how it was.

To put it briefly, another malfunction occurred last winter on our oldest railroad, one of the biggest in the country. Only the passengers of the exemplary "Red Arrow," for which, come what may, the mainline is always cleared so as to ensure its departure and arrival exactly on schedule, could have failed to notice it. But if you take, for example, the Sevastopol or Gorkiy trains, they apparently completely ceased arriving on schedule. And a quite incredible muddle resigned in freight transport operations.

As you know, you cannot walk quickly along a street crowded with people, however much you push. It is even more difficult to attain high speeds on a railroad crammed with cars, where there is no way that two trains can pass on one set of rails. Meanwhile, at the beginning of last year, 25,000-30,000 cars had built up on the October Railroad in excess of what was prescribed according to the norms: how can freight be dispatched on schedule in such a crush!

Triple stocks of iron ore concentrate, which Cherepovets metallurgists were urgently awaiting, built up at the mining and enriching combine at Kostomuksha.

There were towering mounds of undispatched apatites in Kirovsk.

The "Vremya" television program sounded the alarm about an acute shortage of paper bags--the very ones which were piled up in not only the warehouses but also the shops of the Segezha Pulp and Paper Combine.

Petroleum products were being delivered from Kirishi with serious interruptions...

In short, malfunctions and congestion. The railroad, as the specialists say, kept on "grinding to a halt." And the letter from the old steam locomotive engineer from Dno Station reminded us newsmen of this once again and called us out.

But then an event occurred which made us postpone our trip for a while.

In the middle of last March A. S. Petrov was removed from the post of chief of the October Railroad by a decision of the Railways Ministry Collegium "for negligence in his work and personal indiscipline."

Gennadiy Matveyevich Fadeyev was appointed its new chief, having previously headed the Krasnoyarsk Railroad.

A change of leadership is a serious, if not an extreme, measure. It is hard to say whether there is more risk or hope in it. It always entails arguments, doubts and the invariable question of whether the role of a single person in present production life is so great that his arrival can radically change something. On the October Railroad, for example--a very intricate transport complex in which tens of thousands of people work...

Fierce production "commanders," leaders who set themselves up as tribunes and gambled chiefly on people's enthusiasm and on "screwing screws"--is their time not past? And is it not clear that, if a major production facility is in disarray, there might be objective reasons?--they have cut capital investments, set a plan not backed up by supplies, or failed to allocate new equipment. How many times in conversations with leaders who have ended up in difficulties have we had to listen to a long and motley list of difficulties and problems!

Incidentally, a whole "bunch" of them had also accumulated on the October Railroad. Aleksandr Semenovich Petrov, its former chief, told us about them.

It was a difficult conversation with someone who had started out as the man on duty at a small station, become an engineer, made his way up to being a leader on such a scale, and suddenly "plummeted" down so that he ended up even outside his own sector, outside the railroad life which, by the way, had been his whole life. We can only guess at what he feels on reading the railroad newspaper to which he continues to subsribe to this day.

But these are personnel experiences and, when choosing between feelings and actions, priroity must nonetheless be given to the latter. As regards actions, our interlocutor did not generally dispute the fact that one year ago he failed to find a way out of the grave situation. But he explained that shortcomings had begun to accumulate in the business even before his, Petrov's, arrival...

Yes, the situation was difficult when an unfamiliar middle-aged man, dressed not in a uniform but an ordinary suit, almost entirely gray-haired, with a face genial rather than strict, on the evening of Sunday, 18 March 1984 entered the railroad administration, the room of the duty officers which receives information about the movements of all trains right around the clock, introduced himself briefly to the shift leader--"Fadeyev, chief of the railroad"--and asked to be shown the schedules.

Later there was a lot of talk about that visit. No wonder: previous chiefs had hardly ever called on the duty officers, but this one had not yet been introduced to the collective, if you please, yet he had already put in an appearance--and on a Sunday evening moreover...Was this not in order specially to show: this is what kind of worker I am?

Later, having gotten to know him more closely, the managers realized that he had not, of course, been playing "to the public" then at all. He had arrived in Leningrad on an after-dinner flight and booked into a hotel. He had no acquaintances in the city, and the next day there would be a conference, his first meeting with the leaders of services and divisions, and so Fadeyev decided to form his own opinion about how the railroad was "moving." And that was why he went to see the duty officers.

Glancing at the first, second and fifth schedules, he clearly saw--no, he felt almost physically--the picture of congestion. On the schedule panels, among the lines running steeply upward, which denote trains moving without a hitch, the trains which had come to a standstill were marked by woefully drooping horizontal strokes. These schedules resembled a drawing of a rye field beaten down by hail. Whereas at home, in Krasnoyarsk, Fadeyev would have found right on the schedule a note about the reasons for every above-norm holdup, here, alas, it turned out that the duty officers here made no analysis and could not explain the reasons for congestion or, still less, recommend how to "extricate" trains from them.

Is this really the October Railroad--Gennadiy Matveyevich thought in perplexity, not suspecting what amazing discoveries awaited him.

There is no denying that the October is a special railroad, although many people take it to be just the Moscow-Leningrad mainline with two daytime company expresses, the famous "Red Arrow" train, and the legends about the high-speed "Russian Troika." Naturally, the railroad workers are better informed, but even among them the prestige of the oldest railroad is unquestionable. For Fadeyev too, ever since he was a boy, it had been the embodiment of everything that is best in our transport system. How many advanced and progressive innovations there have been here! And what people have worked here!

When it was suggested that Fadeyev think about a move to the October Railroad (as chief!), he could not help remembering the distinctive figure of Boris Konstantinovich Salambekov, who headed this railroad during the hard war years and was awarded the Gold Star of a Hero of Labor during the blockade. Fate (and circumstances) saw to it that after the war Salambekov was transferred to Siberia and Fadayev, a young specialist from Tayshet station, got to see at work the ruthlessly demanding, formidable, and at the same time especially wise "Tsar Boris," as Salambekov was jokingly known throughout the East Siberian Railroad.

Fadeyev also remembered Boris Pavlovich Beshchev, who, while he was minister, gave him his blessing as chief of the railroad's Tayshet Division when he,

Fadeyev, was so young that there had probably been no one younger than him in such a post. Of course, he knew that Beshchev had also been in charge of the October Railroad before the war. And the very idea that he could hold that post seemed incredible.

When he agreed, Fadeyev could picture only in general outline--from documents and from sessions of the ministry Collegium--the fact that things had been far from brilliant on the October Railroad in recent years. But it is one thing to be informed "in general outline" and on the sidelines, and quite a different thing to delve into the details of all kinds of troubles and problems, conscious, moreover, that it is up to you to resolve them.

And a picture was revealed in which it was no longer a question of any individual "shortcomings," but of laggardness in the railroad's material and technical base. This in itself reduced the possibilities of increasing the speeds and weight of trains.

One fact which he encountered during the very first days after arriving in Leningrad was particularly striking. And it unsettled him. It turns out that part of the subgrade destroyed during Hitler's invasion has still not been rebuilt, including the second tracks on a number of spans. And it is quite inexplicable how it could happen that the third tracks have not been rebuilt on the Leningrad suburban section of the very busy Moscow line, where many suburban electric trains join the unremitting flow of long-distance trains. Even before the war the two-track railroad was inadequate there, and yet traffic has become many times more intensive since then!

But perhaps they have relieved the pressure on this very important mainline in a different way? For example, by sending freight trains to Moscow not along the mainline, but along a tranch line--the Savelovo line? Before giving the green light to expresses which now reach speeds of 160 and 200 km per hour, the mainline, which passes through Bologoye, had to be reconstructed. It too. years of work and considerable expenditure to create a "velvet track" with its characteristics special laying of the rails with millimeter accuracy. Only what would be left of this "velvet" beneath the wheels of freight trains?

It is clear that the problem must be solved by a relief line, the need for which is obvious. But the freight flow cannot yet be increased on the Savelovo branch line. When Fadeyev went to Savelovo, where the two railroads--the October and the Moscow--meet, the problem appeared before him as if it were set out in a school textbook. A two-track section with an excellent subrade, along with electric trains speed, approaches the station from Moscow. A single-track line, on which diesel locomotives run, stretches out in the other direction, toward Leningrad. Later Fadeyev also saw something similar at Cherepovets.

In short, the new chief did not need much time to see the accumulation of problems great and samll, which could easily have confused him. Moreover (and let us take this into account), he had come to an unfamiliar collective, where for many people the previous chief, who had grown up there, was their own man, while he was a stranger, a "man from outside"--from the periphery, moreover. And people were on their guard: where would the new "chief" start? It was probably possible to surmount that invisible barrier only by starting his work sensibly and successfully. This was why the questions "what do do?" and "where to begin?" were for Gennadiy Matveyevich on a par with Hamlet's classical question.

So where, then, was he to begin?

[3 Apr 85 p 3]

[Part 2 of article by IZVESTIYA special correspondents A. Druzenko and A. Yezhelev under the rubric "The Personnel Question": "Ode to Risk: Letters from the October Railroad"]

[Text] Leningrad--So how was the new railroad chief to begin, embarking on his duties at a time of prolonged disruption?

A. Makarov, secretary of the railroad administration party committee, who, incidentally, also worked under the previous chief, noted, in conversation, Fadeyev's ability unerringly and rapidly, in any situation, to define the "bottleneck" and--even more important"--to find a way of eliminating it.

No doubt the ministry, when it sent Gennadiy Matveyevich into the "breach," had also taken account of this ability of his. Today, now that any matter is many times more complex, it is important to see everything as a whole and in its individual components, particularly singling out those which are the "problem areas" at a given moment.

True, Fadeyev himself thinks it is not a question of any special abilities of his, but that in the initial stage he, as a new person with a fresh eye, was immediately struck by things the old hands on the spot had gotten used to.

With his "outsider's" eye he discovered a mass of shortcomings. There were problems of a radical nature, stretching far beyond the horizon. But there were also "burning," really blinding, immediate problems, such as the congestion which was not allowing the railroad to "get up steam."

So what should be tackled first?

It is only in theoretical systems that a leader is regarded as modern if he lets current tasks take care of themselves, according to plan, while he concerns himself only with radical, long-term issues. However, desirable this situation may be, in life, alas, things still usually happen differently. And Fadeyev would not have been a modern leader,

paradoxical as it may seem, if he had concerned himself with distant prospects and shrugged aside the congestion and other immediate "problem areas."

"Where to start?" This was also of psychological importance: his subordinates were, inevitably, watching him and his first steps with keen, even overcritical attention.

He began by inviting Pavlov, chief of the track service, to see him, and saying:

"It depends on you and me today, Aleksey Nikonovich, whether the concentrate continues to accumulate in Kostomuksha or whether we manage to ship it out. The trains travel extremely slowly there. Go and see whether we can increase the speed," and, after a moment's silence, he added: "The tract is weak, but I wonder whether in some places the speed is kept to the minimum just to be on the safe side. Find out, and call me. Any time."

Pavlov lef the same evening. Two days later he reported from Karelia: Over some kilometers the speed restrictions could indeed be lifted, but in some places the rails would have to be changed.

"We'll change them, then," Fadeyev said. "Prepare the data."

"But there are no rails," Pavlov objected indecisively. "The railroad has been assigned enough to replace 12 km for the whole year. But it will need at least 50 km for Kostomuksha alone..."

"Prepare precise data," Fadeyev repeated drily, in a more formal tone. "We must take care of the shipments. We will find the rails. And secondly," he softened his tone again, "you should bear in mind, Aleksey Nikonovich, that we will be shipping Kostomuksha's freight by heavyweight trains."

There was a long crackling noise at the other end of the line, then an astonished voice cut in:

"What?..."

"Heavy consists, I tell you. Not 4,000-ton trains, as usual, but 8,000-tonners. Think about it, I'm asking you what needs to be done to prepare the tracks for the throughput of long trains."

Heavyweights...The opinion was current in the administration that the October Railroad had already come near to the optimum average train weight, and virtually nothing was being done to increase it. Heavyweights are a troublesome matter. The standard length of station tracks in our country is 850 or 1,050 meters. If you double the consist lengths, it extends for 1,700 meters, and if you treble it, 2.5 km! That means that

in order to pass a train in the other direction or allow a passenger train to overtake, you have to reconstruct the tracks at the stations. But the October--here's the paradox!--had not requested an increase in capital investments. On the admission of one of the old hands at the administration, the leadership had even felt easier if fewer resources were allocated: then there was less work and less responsibility.

One way or another, Fadeyev's intention to ship the Kostomuksha concentrate by heavyweight trains pleased some people (precisely because it was risky) and caused fear, and sometimes thinkly disguised displeasure, in others.

When Karelia heard about the new railroad chief's plans, a call came in from there:

"If the train is derailed, who will be responsible?"

Only too frequently we still find words and deeds going along like two parallel lines, without touching. We call on the economic manager to display initiative and enterprise, we speak of his boldness, his right to take a risk, provided, of course, that it is backed up by calculations, experience, and intuition, but when it comes to action, to a decision involving a risk, the "inspirers" try to sit it out on the sidelines. The output from a huge combine was not being shipped out, but some people thought it better to do nothing rather than to take a risk.

Fadeyev realized that the freight which had accumulated over the winter could not be shipped out except by heavyweight trains. And he specified that two locomotives, coupled together, would be driven by one team, not two.

This step too had its own special meaning.

In the days of congestion, the ministry was prepared to help the October in any way at all. When, because of the endless demurrage, it transpired--another paradox!--that the railroad's own locomotive teams were in short supply, they started sending in engineers from other railroads. By the time Fadeyev arrived in Leningrad, they were sending in teams from Belorussia, he Ukraine, the Urals, the Volga region and even Siberia! Cut off from their homes, the people were living in hostels and all kinds of adapted premises and railcars. Yet the benefit to the cause was basically illusory. Because the railroad was blocked by congestion.

The heavyweight trains were supposed to "break" this vicious circle. But there was an obstacle in their path which it was not very easy for the chief to remove, least of all by means of giving an order. There was a kind of psychological resistance on the part of some of the transport workers, track men and locomotive men, who could not imagine how it is possible to put through a train which does not, in general, fit into the usual framework of the traffic.

This blind, subconscious resistance had to be broken. But how? By what means? Preferably by a convincing and, if you like, bold example. To use the language of chess players, Fadeyev had to make a move that was not only correct, but elegant.

Suddenly an idea came: what if a large heavyweight train was to pass along the main--Moscow--line? The Kostomuksha branch line was not yet ready for the experiment, and it was not a very noticeable place for an initiative. But the Moscow line could have been designed for the purpose! Although, on the other hand, the responsibility would be enormously greater in the event of failure.

At 0700 hours on 21 April, at the start of the Lenin subbotnik [voluntary Saturday work], electric locomotive engineer Valentin Nikolayevich Kuznetsov (6 months later he was to win a USSR State Prize) with his assistant Sasha Krylov drove a train out of the switching yard onto the Moscow mainline carrying 10,000 tons of grain--three times the usual weight! The unusual train extended for 3 km, and ran rapidly as far as Bologoye without stopping. "Everything is running on schedule," Fadeyev reported to Nikolay Semenovich Konarev, the minister, who knew about what was happening and seemed to be concerned about the Leningraders.

In the evening the tripled consist arrived in Khovrino Station in the Moscow region. The experiment was undoubtedly a success!

Then came the turn of the first heavyweight train from Kostomuksha. The unsafe rails there had been replaced. All the same, the railroad chief was not happy. The old "timber train" between Suoyarvi and Ledmozero could indeed spring all kinds of surprises. At the last moment Fadeyev called Petrozavodsk, tracked down locomotive service chief Mikhail Andreyevich Isayev, who had worked on a diesel locomotive for many years, and asked him to sit alongside the engineer on the first Kostomuksha heavyweight. As if his mere presence in the cab would protect the train.

In six weeks, there was a not a hint of any above-norm stockpiles of concentrate at Kostomuksha.

But let us be realistic. If "bottlecks" on the railroad can be compared to contractions of the blood vessels, the entire "benefit" of heavyweights may amount to the fact that instead of ordinary trains being held up, it would be doubled or tripled consists.

Naturally, Fadeyev realized this. And from the first he concerned himself with managing the railroad, setting his sights first of all on those problems whose resolution did not require too much time and effort, but which could really improve traffic. And here it must be said frankly that in a sense Gennadiy Matveyevich was lucky. "Lucky," in that his predecessors were not very efficient. As the previous railroad chief explained to us, lamenting the excessive workload of day-to-day concerns, he "had no time to look ahead and take a long-term view."

There is a railroad junction near Leningrad where two relatively busy lines meet--the Volkhovo line and one that provides access to the southern and Baltic routes via Shushary. The Volkhovo branch line, which had been electrified, was constantly crammed with trains before this junction, because the locomotives were changed there if the train was going to the Shushary (the line there was not electrified). Diesel and electric locomotives met on the main line, got in each other's way, and caused congestion. Did the specialists realize that to work in this way is too wasteful? They realized long ago. They even planned to do the necessary work. But it all dragged on, until Fadeyev came and saw a way of "disentangling" the situation. And something could be done--if only to partially electrify the junction, so that locomotives could be changed there, and not on the main line.

And there were many such "disentanglements."

It is essential to bear in mind that Fadeyev did not make any discoveries. All of this--the heavyweight trains, ways of clearing "bottlenecks," the improvement of station management--is well known in transport. The point is that, first, he knew what to do, when to do it, and in what order, and second, he was bold enough to say "it can be done" where it seemed to many people that "it couldn't be done."

Naturally, under the new chief there was a marked increase in the load on various services and construction subunits. They had to do planned work as well as work that was not planned! Station tracks were hastily rebuilt, "bottlenecks" on the Leningrad suburban sectors were cleared, and into the bargain Fadeyev raised the question of increasing capital repairs to the tracks by means of creating "windows," that is, stopping traffic on the sector under repair for a few hours.

In conditions of busy traffic, "windows" mean extra holdups. So the plan for capital repairs to the tracks was not fulfilled from one year to the next on the railroad. Nonetheless, "windows" continued to be canceled. For instance, in August 1983 they were completely abandoned on the orders of the then railroad chief.

Fadeyev banned the canceling of "windows." Do you see the difference? He banned it! In 1984, for the first time for many years, the capital repairs plan on the October was fulfilled and even exceeded.

It appeared that what was now being asked of the construction, track and locomotive workers was something entirely different from what they were accustomed to. And once, when Fadeyev started to say at a conference that "routine tasks" were being poorly fulfilled, his deputy for construction could not contain himself.

"I am the deputy for projects included in the plan," he said slowly. "But these secondary..." He did not finish the sentence, but his tone and the expression on his face finished it for him.

"What was that about?" Gennadiy Matveyevich wondered when he was alone. "Lack of restraint? A chance interruption? Disagreement from a tired man? Or perhaps he was hinting to me: You're going too far..."

He remembered his parting conversations at the ministry. They had told him: there are poor workers and people with a casual attitude in the administration; some will be dissatisfied, it's inevitable. Find out for yourself; we won't object to anyone's replacement."

Leningrad too, he realized, would not object. He could transfer over here some of the people he had known well in Siberia, whom he could rely on. Who would reproach him for it? Especially since there were already letters from Siberians in the bottom drawer of his desk, containing requests. Perhaps he should invite some of them? After all, personnel, as people used to repeat persistently at one time, decide everything.

[4 Apr 85 p 3]

[Part 3 of article by IZVESTIYA special correspondents A. Druzenko and A. Yezhelev under the rubric "The Personnel Question:" "In His Place; Letters from the October Railroad"]

[Text] Leningrad--The Leningraders mainly interpreted the dismissal of the former railroad chief as being in the natural order of things. Because they could see that the railroad was operating worse with every passing year, and almost everyone had complaints about the October Railroad. Some mentioned that they could not squeeze onto an electric train anywhere at Mshinskaya Station, others mentioned the lateness of the trains and that now remote time when you could check your watch by the arrival of a passenger train. Of course, they mentioned the freezing cold cars, the huge lines at the advance tickets sales office near Kazan Cathedral, the not overpolite conductors, the railroad tea which wits had dubbed "sleepless nights tea"--in brief, everyone remembered from his own experience faults committed by the railroad workers and summed them up with the seemingly logical conclusion: it is high time they were tackled! When they found out that a "stranger" had been chosen as the new railroad chief, many people said: well, he'll get rid of everyone.

Rumors are always exaggerations, hyperbole, and there is no point in itemizing them in a newspaper. But in this case the somewhat exaggerated idea that a new leader should "upturn" his presonnel was in general not so far from the truth.

Well, imagine the point you can reach if a new leader is warned when he is briefed on his job that at that particular moment he in fact has no first deputy and no chief engineer and some of the services are headed by people in the "wrong" place.

True, we have departed from strict accuracy in putting it like that. We have departed from strict accuracy to show not the seeming but the true situation

with regard to cadres at the railroad administration when Fadeyev came there. That is, there was a chief engineer. But he was working out his last few days. And soon after the new chief arrived he departed for what in such cases is termed a well-earned rest. We cannot say the two events are connected. After all, by that time the chief engineer was long past pensionable age and the question of it being time to give him an honorable farewell had long been raised.

We realize we are touching on delicate matters and may hurt someone's vanity. In general, giving people standard character references ("was born...graduated from...headed...enjoys authority") is one thing, while objective references, with all a person's pros and cons and with no varnish, are quite another. But you cannot do without these sober and objective references when selecting cadres. Personal sympathies or antipathies cannot be used as arguments here.

After all, it was no secret that the need to rejuvenate the personnel had become a problem--yes, a problem--for the October Railroad administration. And the Leningrad party obkom which, incidentally, frequently drew attention to the shortcomings in the railroad workers' work, frankly pointed to the fact. In particular, permanent personnel were told that the percentage of people of pensionable age in the leading management echelon was too great. However, and here we agree with N. Gustov, deputy chief of the railroad for personnel, it was very difficult to resolve this problem. People would say they felt sorry for one person, another had ties, another was for some reason retained in a post which should long since have been given to a more vigorous specialist. Misplaced indulgence, let us be frank.

As you have probably guessed, there was also a specific specialist in the place of the first deputy. But here the problem of suitability--or unsuitability--for the post made itself felt. As an industrious, skilled engineer and analyst and, most importantly, a man with an unusually gentle nature, he lacked the firmness and professional grasp without which, of course, it is hard to be the second-ranking official at the railroad. Nor was this a secret to the apparatus, just as the replacement of the former first deputy by the chief engineer was no surprise. It is logical, because what is more important in personnel policy than the suitability of a person for the post he occupies!

When Fadeyev was presented at the railroad administration, a meeting was held. The services leaders and division chiefs (or "chiefs," as they are called for short) reported on the current situation. Fedeyev immediately noticed for himself the energy with which some people parried the questions put by the minister holding the conference. Evasiveness was clearly to be detected in the "retreating" replies: create the conditions for us, they said, and we will work for you.

For instance, the car service chief was asked: Why, on the one hand, do you hold on to a large number of cars but on the other fail to load apatite and paper? "I don't know what cars you're talking about," came the reply.

"'Sick' cars (that is, cars in need of repair--author) are coming in to us from all sides. But, as you know, we have no repair base and no manpower."

Several days passed and Fadeyev sent specialities on business trips and they --on careful examination--were to discover that over half of the "ailing" cars were in fact either "healthy" or in need of only trivial repairs. They were immediately put into service.

The "personnel" solution was obvious, but the car service chief forestalled it. He came to Fadeyev with the words: "I feel I won't make it. I have worked too hard." He complained of tiredness and said that his tasks had become more complex, that it would be better if someone more energetic, a real "car expert," were chosen in his place. (An unexpected "discovery" was made here. It turned out that the man who had headed the car service for many years did not consider the work to be his own and for a long time, even under the two previous railroad chiefs, had been asking for another assignment. But on each occasion he was told: "Never mind, keep working!") And here there came a sorry confession: "I have worked too hard, I won't make it." And a request: "If you have no objections, I should like to become an inspector in one of the divisions here." Fadeyev did not object. That was probably also logical.

Fadeyev immediately noticed the chief of the traffic service. He began to notice that the latter was turning up at plan progress conferences still "under the influence," to put it diplomatically. Soon something happened to him at work which meant it would have been naive for him to pretend to be a teetotaler. The traffic chief had to be dismissed.

Those where in fact all the personnel reassignments which Fadeyev made. And locally matters were restricted to the enforced replacement of just 2 "chiefs" out of 11. Kemskiy had completely neglected his work, with his too great liking for drink, while the Murmansk man proved so incompetent that it was impossible to understand for what "services" he had been promoted to that rank. "People here don't get sacked for doing nothing," the Murmansk people had joked bitterly.

In any case the personnel "revolution" on the October Railroad did not take place. But as for the style of work-by people and with people--the changes were considerable.

It is no coincidence, for example, that after Fadeyev arrived, many administration workers suddenly discovered a hitherto unnoticed passion for traveling...on their own railroad. To it furtherst outposts, where people had never before set eyes on a living soul from the administration.

For the administration's management, such tours of duty are not only compulsory, but are also monitored by a special schedule. Gennadiy Matveyevich requires that deputies returning from assignments produce a report stating which questions have been resolved at the local level, which

people they talked to and in which collectives, what complaints and claims were made, whether anything was done on the spot to resolve those complaints, what else needs to be done, what help is needed, and so forth. You have the feeling that Fadeyev himself simply has to have direct constant contacts with people at all levels from top to bottom.

He has loved and respected railroad workers since childhood. Since that time when he was growing up in a worker's family at the depot in his native Shimanovsk on the Transsiberian Railroad, when he learned to distinguish which engineer was driving his train toward the station by the sound of his engine whistle and when he began his own engineering career at Tayshet Station after graduating from the Khabarovsk Railroad Institute.

It is difficult to draw conclusions, of course, even though we spent about a week traveling to the railroad administration as if it were our regular job, attending telephone conferences, and talking with specialists. Nevertheless, regarding style, we would venture to suggest that more than any other the epithet "strict" applies to Fadeyev as a leader.

He is punctual, and will not tolerate lateness in others. He is a man of few words, particularly in his instructions. He is sparing in his praise and can pass over someone's success in silence but cannot overlook a mistake and will point it out unfailingly. Outwardly he is impassive, showing neither likes nor dislikes and treating everyone equally. He himself takes no vacations, but how do his subordinates take that? As a hint?

People's comments give the picture of the man.

We do not intend to idealize him or set him up as a model. We will only point out that most people, it seemed to us, regard Fadayev's rather dry austerity, if not with liking, then at any rate with understanding. People are fed up with empty words. In the absence of--and the immense desire for--order this somewhat severe way of acting appears more modern and convincing than an impulsive style. If you recall, we were directing our story toward an "intriguing" questions: Would Fadayev take his "own" people--those he knew and were proven on the job--from the Siberian railroad? He did not. Why? He did not feel the need. Again, why not? Because he knew it is possible to work by changing the apparatus' view of work rather than by changing the composition of the apparatus itself.

People do not accept a manner like his straightaway, but when they do, they become not simply colleagues, but people who think the same way.

For example, the elaboration of the railroad's technical development program through 1990 and beyond had begun even before Fadeyev's arrival. But it was he, and moreover, during the busy period of clearing congestions when it appeared all he could think about were the concerns of the moment, who took that matter in hand and was able to so enthuse the specialists that

they literally spent day and night on the job at the administration. They waded through mountains of material and considered seven options before finally elaborating the "intensification-90" plan, which is now part of the well-known overall program for Leningrad.

Without going into specific details, let us draw attention to something else--the enthusiasm and commitment with which the people have worked. "Imagine," said V. Shmatov, deputy chief engineer of the railroad, with a smile on his face, "it is June, around 9 o'clock in the evening, we are considering the fifth or sixth version of the program. The chief engineer is wanted, I ring the duty officer and say: "Hello, is Shmatov there?' I asked to speak to myself...How do you like that?"

It is probably time for conclusion now. When Fadeyev took on the October, the railroad was at a standstill, as the professionals say. But about 2 months later it was running. Whereas early last year 25,000-30,000 cars above norm had accumulated within the railroad, by the end of the year the freightcar park had been substantially reduced and virtually brought within the norms. The average weight of trains last year rose 118 metric tons--an unprecedented increase! In the recent past, the railroad used to fulfill the plan for freight dispatch on "32 December," that is by amending the plan--downwards, naturally. Last year there was no need for an amendment: the plan was overfulfilled.

It is true that in mid-January, when we were going to the administration as if it were our regular job, you could sense the tension: the harsh winter, the snowdrifts, the frozen freight. The month's plan was in jeopardy. Was it necessary that, having ended the year so well, they should be faced with stoppages once more?

It was about then that somebody threw a note onto the railroad chief's table. An anonymous note. A very laconic note. No appeal, no "personal" comment. Just two columns of figures, one listing the years since 1970, the other the indicators for the average daily shipments for January. Fadeyev cast a fleeting glance over the figures: 325,600 metric tons in 1970; 477,700 metric tons--the very highest--in 1980; and in 1984 some 458,700 metric tons. "His" plan for January 1985 stood out sharply: 510,000 metric tons! He immediately understood the hint: Look, chief, that's a bit steep!

But the start of the year really was incredibly difficult. The October underfulfilled the plan. Admittedly only slightly--by a little over a day--but it still underfulfilled it.

So we can turn the subject around a different way: at the start of last year under the old chief, there were stoppages, people say, and this year under the new chief the same thing has happened--what's the difference?

How many times has this happened: production goes downhill; the director (chief) is removed; a new one arrives; at first he is given all kinds of

help; matters improve; the help is discontinued; the plan is increased; matters deteriorate; indicators go downhill; the director is removed, naturally, and a new one is appointed, who--at first--is given help, and... it all repeats itself.

Is not something similar happening at the October? Was Fadeyev helped? He was helped: he asked for rails in excess of the plan and got them, he asked for diesel engines and got them, for contact conductors which were in short supply and he got those. At first matters seemed to improve, but the plan wavered again. And people are already saying to Fadeyev: We were premature in starting to praise you, weren't we?

No, I believe that the case is still very different here. First of all, we must not discount the fact that this year the October resolved to sharply increase shipments (including by 11 percent in January). And it has increased them! Not by as much as planned, it is true. But let us note how the situation has changed. The stoppage at the beginning of last year manifested itself visibly in mountains of undisptached freight--the railroad did not, could not, transport them. This year started with the opposite being true: there was not enough freight for the planned volume of shipments. They sought out freight and begged enterprises to speed up the delivery of products. Do you see the difference?

Not everything, of course, depends on Fadeyev and the one railroad! The railroad is a little cog in the enormous national economic machine. It must be in good order, that is true, but it cannot "turn" all by itself.

Fadeyev has shown what changes can be secured by more energetic leadership and the strengthening of order and discipline. However, many problems accumulated over the years have still not been resolved. And there also remains the possibility of interruptions. Well, what about the following appalling detail as far as this feature is concerned: one frosty January evening one of the authors bought a ticket for Moscow on the No 51 relief train, which set off from Leningrad not at 0135 as stipulated in the timetable, but at 0530!

So, although a considerable amount has been done, it is still too early to flatter ourselves. There are still shortcomings, there is still something for the railroad staff to work on. The most important thing, it seems to us, is that Fadeyev's example has reaffirmed that personnel really do solve a great deal. A very great deal. But still not everything.

There is nothing unique about what has happened on the October Railroad. Some leaders who have not coped have been replaced by others in the past and will continue to be replaced in the future. And given the increased demands on the standard of leadership, this may happen even more frequently. That is, without waiting for critical situations or any kind of emergencies.

Nonetheless, it would be the height of naivety to suppose that these changes themselves remove the basic problems of production development. But does this really cancel the need for personnel renewal?

All in due course.

CSO: 1829/206

RAIL SYSTEMS

MINISTRY HOLDS INTERNATIONAL RAILWAYS COMMO CONFERENCE

Moscow ZHELEZNODOROZHNYY TRANSPORT in Russian No 2, Feb 85 p 70

[Unsigned article: "Events, Reports, News: Radio Communications Today and Tomorrow"]

[Text] The Central Administration of the Scientific and Technical Department of Railroad Transportation and the Central Scientific Research Institute of Railroad Transport Information, Technical Economic Research and Propaganda, in conjunction with the Signals and Communications Main Administration of the Ministry of Railways, organized and held an All-Union Theoretical and Applied Conference on the subject of "Broadening the Sphere of Application of Modern Radio Communications Equipment in Rail Transport." Specialists of the Ministry of Railways, officials of the service and line enterprises of signals and communications, representatives of scientific research and planning and design organizations and transportation higher educational institutions, as well as specialists in radio communications from Bulgaria, Hungary, North Korea and the CSSR took part in it.

Conference participants discussed a broad range of issues associated with the further development and improvement of radio communications on the country's steel mainlines, accelerating the incorporation of new radiotechnology and increasing the efficient use of existing communications equipment, and become acquainted with the prospects and advanced experience in the operation and maintenance of various radio communications systems and equipment.

It was noted that radio communications in railroad transportation in recent years is developing at an ever faster rate. In the 11th Five-Year Plan, railroads have already received 1½ times more radio stations than over the preceding five years. The use of radio communications is becoming firmly entrenched in the work of train dispatchers ard station workers, engineers, car inspectors, power engineers and representatives of many other railroad professions.

All of this has a favorable effect on the improvement of railroad operational activity and the increase in safety of train traffic, and makes for a more flexible, practical and efficient management system for the transport process. For example, the use of radio stations on a double-line dispatch section 120 kms. in length with traffic of 65 pairs of freight trains and 8 pairs of passenger trains allows an increase in the sectional speed of freight and passenger traffic corresponding to 0.52 and 0.28 kph., respectively, resulting in savings of hundreds of thousands of kilovolt-hours of electricity, the more efficient use of locomotives and cars, and an annual economic savings of approximately 100,000 rubles.

The principles of construction, features, technical and economic characteristics and advantages of the Transport Complex of train, station and repair operations radio communications systems, the development of which has reached the completion stage, were reviewed in detail in reports and presentations of the conference participants. Accumulated experience and problems in preparing operations for the wide-scale incorporation of the radio communications equipment of this future complex, and the creation of the conditions for its effective use, were comprehensively discussed. It was emphasized that the successful solution of these problems is possible only by the joint efforts of communications workers and the workers of the other services with the broad enlistment of the scientific and technical community.

Great attention was devoted to the presentations dedicated to the operational experience of RN-125 class single-watt radio stations, the ensuring of compatability of various radioelectronic equipment, the improvement of the antinoise systems of information transmission, the features of carrier radio stations in a station radio communications system and the creation of a line system of radio communications with access to the Railroad Automatic Telephone System. The developments in the application of radio communications in the operation of line ticket cashiers, car maintenance stations, driving double trains and elsewhere are interesting. For example, the incorporation of the Transport radio station system in the technical inspection point of the Sverdlovsk Freightyard allowed a 0.1-hour decrease in the inspection time of trains, an increase in productivity and an improvement in the working conditions of the car inspectors.

In a discussion of the pressing problems of radio communications development, particular attention was devoted to ensuring the full assimilation of radio equipment arriving at transportation enterprises, especially carrier radio stations, and to the timely replacement of equipment. As practice shows, there are several substantial deficiencies in this important matter at several railroads, and not all subdivisions have yet demonstrated the proper interest and responsibility in speeding up the incorporation of radio apparatus. This is related largely to the fact that the interrelationships among the various services for the incorporation, operation and maintenance of radio communications equipment are not clearly regulated. This problem is not new, but up to the present it remains one of the most topical.

Great attention was devoted to the further improvement of the quality of the maintenance and repair of radio communications equipment at the railroads. The necessity of strengthening the corresponding production facilities, widely incorporating industrial and brigade methods of radio communications equipment maintenance based on the experience of the leading collectives and strengthening work on preventing breakdowns were emphasized. The development and incorporation of methods and equipment for the technical diagnosis of radio apparatus and the creation of small-scale mechanization equipment suitable, for example, for removing and adjusting radio stations, battery chargers and other equipment must be made more active. It is also important constantly to raise the qualifications of maintenance personnel, and to ensure favorable conditions for their work. At the same time, stricter control over the observance of rules for operating radio equipment in various transportation subdivisions must be organized, and a careful and proprietary attitude toward it among railroad workers must be achieved.

Over the course of the conference, the workers of signalling and communications line enterprises expressed many interesting proposals for increasing the reliability of radio apparatus operation, its modernization, more efficient utilization, the improvement of maintenance and the broadening of its sphere of application. It is important that all that is valuable and useful that has been accumulated in the network receives broad and general dissemination. This is a powerful reserve for the improvement of the efficiency of railroad radio communications, and it is necessary to use it immediately and fully in practice.

Many crucial and serious problems are before the scientists, planners and designers of radio communications systems and equipment. It is important not only to provide transportation workers with highly effective and reliable radio apparatus, but also to demonstrate, as skillfully as it can be managed, how to receive the greatest return from the use of radio communications in railroads.

The exchange of opinions and experience that took place and the recommendations adopted by the conference will enable the creation of a reliable system of radio communications in the network, answering the modern and future needs of operation, and the improvement of the organization of the transport of freight and passengers.

12821
CSO: 1829/231

RAIL SYSTEMS

RAILWAYS MINISTRY ANNOUNCES CHANGES IN ACCOUNTING PROCEDURES

Moscow GUDOK in Russian 18 Apr 85 p 2

[Unsigned article: "Official Department: Independent Accounting Offices for Line Enterprises"]

[Text] In order to further broaden the rights of self-financing line enterprises in economic activity, from July 1 of this year in concordance with the Ministry of Railways, independent accounting offices will be organized in line enterprises (where it is expedient) under the chief accountant (senior accountant with the rights of chief) within the limits prescribed to the railroad in the labor plan, management staff quantity ceiling and the maximum allocations to its composition.

Beginning from this date, the decentralization of accounts and credit accounts will be realized in all divisions. Division chiefs are granted the right, in concordance with the railroad administration and local organs of the USSR Gosbank, to carry out the decentralization of credit for above-norm reserves of material goods. Planned amounts as payment of percentages for the use of bank credit are provided for at the expense of railroad division profits in the financial plans of the enterprises.

Beginning from 1986, it is planned to provide for the formation of incentive funds for railroad transport enterprises depending on the fulfillment of the target indicators for funds formation maintained for them, without taking into account the degree of increase (decrease) of the plan incentive funds of superior organizations (divisions, railroads), and also to allot unutilized savings of the wage fund to the material incentive fund of the railroads, their divisions and enterprises at the end of the year.

Line enterprises are granted the right to acquire necessary material and technical supply items from state and cooperative organizations according to agreements concluded with them for production, effected without authorizations, and also by way of purchases in specialized wholesale facilities and in retail stores in the manner established by existing legislation, when there is a lack of materials in the stocks of the railroad supply organs.

12821
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RAIL SYSTEMS

BRIEFS

KIEV METRO CONTROL SYSTEM--Kiev--On the Svyatoshino-Brovarskaya Line of the Kiev Metro an automatic control system for electric train speed (ARS) has been put into service. The cars have been equipped with the ARS system by the collective of the Darnitsa electric depot [subway barn] while the line and station equipment has been done by the metro signal and communications service. This work took 4 years. Now the trains are operated by engineers without assistants. The introduction of the ARS provided an opportunity to use the entire fleet of cars operated on the line for carrying passengers. Some 100 assistant engineers were freed. [By Engr P. Pravoshinskiy] [Text] [Moscow GUDOK in Russian 23 Jan 85 p 2] 10272

MOSCOW METRO EXTENSION CONSTRUCTION--Today construction has started on the first meters of the line tunnel for a new metro line. The trains of the Kaluzhsko-Rizhskaya Line, having started their run from Medvedkov, 44 minutes later finish at Belyayevo Station. From here an underground line will be extended further to the southwest to the major residential districts of Konkovo, Teplyy Stan, Yasenevo and other districts of Brezhnevskiy Rayon. Construction workers from the SMU [Construction-Installation Administration] No 11 of Metrostroy [Metro Construction Administration] have been the first to start work on the new line beyond the end tracks of Belyayevo Station. These workers are to extend the line tunnels and build the first Konkovo Station. At the construction sites preparations are being completed for the basic work. At present the brigade of V. Bobrov has cut the first meters of the line tunnel. In competing to properly celebrate the 40th anniversary of the Great Victory, the cutters decided to build 100 m of tunnel by 9 May. "On the extension of the Kaluzhsko-Rizhskaya Line--almost 7 km of new metro line--there will be four stations," related the chief project engineer from Metrogiprotrans [State Design Institute for Metro Transport], V. Shmerling. "The first, Konkovo, is being built at the intersection of Profsoyuznaya and Ostrovityanov Streets. After it is Teplyy Stan at the intersection of Profsoyuznaya Street and Novoyasenevskiy Prospekt. Between Taruskaya and Yasnogorskaya Streets, at their intersection with Novoyasenevskiy Prospekt, Yasnogorskaya Station will be built. The terminal point will be Bittsevskiy Park Station." [Text] [Moscow VECHERNYAYA MOSKVA in Russian 11 Feb 85 p 1] 10272

NEW MOSCOW RAIL FACILITIES--On the territory of the freight yard of Moskva-tovarnaya-Kurskaya Station a large hangar-type warehouse has been built over 300 m long and this can hold 20 cars. Installation of the frame of a nine-story service building has been completed. In it will be a conference hall,

a dining room which can seat simultaneously 100 railroad workers at tables, changing rooms, showers and other sanitary service facilities. In this same building will be the administration and social organizations, the dispatcher offices, freight offices, the medical service and an automatic telephone exchange. The service building will be connected with the warehouse hangar by a light, warm passageway. Construction work is being carried out by the collectives of the SMU-328 and SMP-248 [construction-installation train] of the Mostransstroy [Moscow Transport Construction] Trust with related organizations using technical specifications of Mosgiprotrans [Moscow State Design and Research Institute of the USSR Ministry of Transport Construction]. [By I. Vol'skiy] [Text] [Moscow GUDOK in Russian 24 Feb 85 p 2] 10272

MINSK METRO TUNNELING PROGRESS--Minsk--With the aid of a new tunneling unit the brigade of the SMU-2 headed by A. Prasolov in January set a new record: in 18 days it cut 101 m of tunnel. In honor of the 40th anniversary of the Great Victory a decision was taken to complete the cutting of the first tunnel between the future stations of Traktornyy Zavod and Proletarskaya some 2 months ahead of the planned date. The tunneling team of M. Chupin is in the vanguard of this brigade. [By S. Dmitriyev] [Text] [Moscow GUDOK in Russian 26 Feb 85 p 3] 10272

KODAR TUNNEL NEARLY OPERATIONAL--Kodar, Chita Oblast (TASS)--The Kodar Tunnel of the Baykal-Amur Mainline has been clothed in a strong concrete "shirt." The reinforcing of the arch and walls of the enormous underground corridor has been fully completed. For this almost 50,000 m^3 of concrete were laid under the mountains. The brigade of Hero of Socialist Labor N. Yeremenko has started preparations for laying the track. The first train will go through the Kodar Tunnel in May. [Text] [Moscow STROITEL'NAYA GAZETA in Russian 6 Mar 85 p 3] 10272

TBILISI METRO DESIGN WORK--Tbilisi--Kavgiprotrans [Caucasian State Design and Research Institute of the USSR Ministry of Transport Construction] has commenced designing new sections of the Tbilisi Metro from the working Delisi Station to Vazha Pshavela Station and from Rustaveli-2 Station to Vazisubani. These sections of future metro lines will be built under difficult geological engineering and hydrogeological conditions. The large amount of underground groundwater, the hard rock and quicksand will require the use of the most progressive tunneling methods. During the current year the collective of the Tbiltonnel'stroy [Tbilisi Tunnel Construction] Administration will begin preparatory work for building the Delisi--Vazha Pshavela Line. The designing of the Rustaveli-2--Vazisubani Line will be completed next year and then its construction will commence. The length of the two new lines of the Tbilisi Underground will total 8 km. [By GUDOK correspondent S. Babayan] [Text] [Moscow GUDOK in Russian 15 Mar 85 p 2] 10272

SEMICONDUCTORS FOR 12-AXLE LOCOMOTIVE--Tallinn--The Tallinn Electrical Equipment Plant imeni M. I. Kalinin has developed and is manufacturing high-speed power semiconductors: thyristors and diodes. They are designed for converters for the new 12-axle electric locomotives which are being readied for production by the collective of the Novocherkassk Electric Locomotive Building Plant. The Tallinn designers feel that their thyristors and diodes are the most powerful not only in our country but in the world and can compete with the best similar devices on international markets. Moreover, they are light and small in size.

The first batch of them has been dispatched to the plant. [By A. Menaker] [Text] [Moscow GUDOK in Russian 6 Mar 85 p 1] 10272

BOGOTOL TESTS VL-85 LOCOMOTIVE--Bogotol--Engineers from the Bogotol locomotive depot of the Krasnoyarsk Railroad must frequently become the testers of new equipment. This time they were the first to operate trains with the experimental VL-85 Soviet locomotive. It is 1.5-fold more powerful than the serially-produced locomotive and is designed for operating on the Siberian railroads, primarily on BAM [Baykal-Amur Mainline]. Instead of the usual 8 traction engines, it has 12 on its axles and for this reason is 10 m longer than its predecessor. The first trips made by the brigade of Engr E. Ushakov showed that the new heavy locomotive is capable of pulling a consist weighing from 6,000 to 8,000 tons under Siberian conditions. [By SOTSIALISTICHESKAYA INDUSTRIYA correspondent V. Zhitnev] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 16 Mar 85 p 2] 10272

TRACTION ENGINE FOR VL-85--Novocherkassk--The collectives of the VEINII [All-Union Scientific Research, Planning, Design and Technological Institute of Electric Locomotive Building] and the NEVZ [Novocherkassk Electric Locomotive Building Works], in collaboration with other enterprises, have developed a 12-axle electric locomotive of the VL-85 series which is unequaled in terms of power and tractive force. It employs a new traction engine of the NB-514 type which was developed on the basis of the serially-produced engine which has proven itself reliable. It is 45 kilowatts more powerful than the predecessor but here it requires 35% less energy for cooling and the consumption of winding copper in manufacturing has been reduced by 100 kg. The economic savings from employing the new NB-514 traction engine will be around 2 million rubles a year. [By V. Shcherbakov] [Text] [Moscow GUDOK in Russian 19 Feb 85 p 2] 10272

VL-85 LOCOMOTIVE DESIGN APPROVED--Novocherkassk--The state commission for the acceptance of experimental design work has concluded that the 12-axle AC electric locomotive of the VL-85 type can be put in a superior quality category. It was recommended that the NEVZ manufacture the established batch in 1985, 5 engines, and begin series production next year. The commissions's protocol has pointed out that in terms of the technical level the VL-85 electric locomotive meets the modern requirements placed on mainline freight locomotives and has high technical indicators. Its use in the national economy will bring about a significant savings. The commission has drawn up an act of acceptance for the prototypes of the VL-85 electric locomotives, No 001-002, where it states that these locomotives significantly surpass the presently produced ones for power and tractive force and also that individual electrical engineering indicators have been improved. [By Engr I. Zin'kov] [Text] [Moscow GUDOK in Russian 2 Apr 85 p 2] 10272

NEW TRANSCAUCASIAN RAILROAD STATION--The new station located on the section adjacent to the existing Tetri-Tskaro Station of the newly built Marabda--Akhalkalaki Line of the Transcaucasian Railroad has been given the name Nadarbazevi (Code 60447). The station has been opened for boarding and disembarking passengers on trains of suburban and local traffic (receiving and delivery of baggage are not provided). The distance from Nadarbazevi Station to Tetri-Tskaro Station is 14 km and to the Leninakan transit point it is 234 km and to Tbilisi-Uzlovoy point 66 km. [Text] [Moscow GUDOK in Russian 16 Mar 85 p 2] 10272

BAM STATION RENAMED--The spelling of the name of the Arakot Station has been changed on the Baykal-Amur Mainline. Now it will be called Orokot. [Text] [Moscow GUDOK in Russian 16 Mar 85 p 2] 10272

GORKIY-KUYBYSHEV RR BORDER SHIFTS--The Tikhonovo--Alnashi section of the Gorkiy Railroad has been turned over the Kuybyshev Railroad. The boundary between these railroads has been set to Alnashi Station, inclusively, for the Gorkiy Railroad. [Text] [Moscow GUDOK in Russian 18 Apr 85 p 2] 10272

NETWORK ELECTRIFICATION PLANNING--The Railroad Electrification Section* has discussed and approved the work of Transelektroproyekt [?Design Institute for Transport Electrification] and Giprotranstei [State Institute for Technical-Economic Research and Designing of Rail Transport] for establishing a general system of railroad electrification for the near future. Accepted for review were 18 sections with a total length of 6,538 km and for which they have established the basic technical ideas, the cost of the electrification work and the effectiveness of introducing electric traction in comparison with diesel. The initial data for carrying out the work were received from Giprotranstei and the administrations of the corresponding railroads. Operating expenditures were set using the current indicators employed in determining effectiveness in actual plans. Crucial for determining the repayment time were the costs of diesel fuel and electric power which were set according to price lists but this does not completely accurately reflect reality, since diesel fuel has tended to increase in cost. The section recommended that Transelektroproyekt and Giprotranstei continue work on developing a general plan for railroad electrification, determining the electrified sections to be completed by year as well as resolve the question of considering the cost of diesel fuel and electric power for the technical and economic calculations. [Text] [Moscow TRANSPORTNOYE STROITEL'STVO in Russian No 2, Feb 85 p 62] 10272

MOSCOW METRO ROUTE APPROVED--The Tunnel and Metro Construction Section* discussed and approved the plans for the construction of a section of the Kirovsko-Frunzenskaya Line (KFL) of the Moscow Metro between the stations of Preobrazhenskaya Ploshchad' and Ulitsa Podbel'skogo with a length of 3.9 km. The extension section of the KFL, because of the conditions of connecting to Preobrazhenskaya Ploshchad' Station and the electric depot [car barn] is to employ shallow-built tunnels. There will be two stations on the line: Cherkizovskaya and Ulitsa Podbel'skogo. Cherkizovskaya Station will be single-arch with track spacing of 12.9 m and has been designed considering the subsequent construction of a second station and the creation of a transfer center. Lobby No 1 is ground-level and lobby No 2 underground. The Ulitsa Podbel'skogo Station is of the column type and track spacing of 12.9 m, with two underground lobbies connected by pedestrian passageways. In the area of crossing Cherkizovskiy Pond, on a section of 140 m the continuation of the line is ground-level, including over a trestle. The tunnels for the line being designed along the entire length are to be built by the open pit method with reinforcing, using gantry and jib cranes for installing the structural elements. [Text] [Moscow TRANSPORTNOYE STROITEL'STVO in Russian No 2, Feb 85 p 62] 10272

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*of the USSR Ministry of Transport Construction's Scientific and Technical Council.

CSO: 1829/208

MARITIME AND RIVER FLEETS

CHIEF ON IMPROVING USE OF RIVER CARGO FLEET

Moscow RECHNOY TRANSPORT in Russian No 12, Dec 84 pp 2-3

[Article by I. Shchepetov, member of the Collegium of the Ministry of the River Fleet and chief of the Shipping and Fleet Operations Main Administration: "To Improve the Use of the Fleet"]

[Text] The level of use of the transport fleet is an extremely important indicator of shipping company operations. A 6-percent rise in the productivity of power-driven and non-powered cargo vessels is specified in the 11th Five-Year Plan. In connection with this, a comprehensive program to increase the use efficiency of the transport fleet has been drawn up by the Ministry of the River Fleet and is being put into practice.

Having examined, in August 1984, the course of fulfillment of the comprehensive program, the collegium noted that it was not being put into practice satisfactorily. For example, in three years of the five-year plan, the productivity of power-driven and non-powered cargo vessels increased by 1 percent instead of 3.6. Only six shipping companies: the Volga United, Northwestern, White Sea-Onega, East Siberian, Amur River and Volgotanker ensured the increase rates established by the plan.

In most of the shipping companies of the eastern basins the use of the cargo fleet is deteriorating. While in the shipping companies located in the European part of the RSFSR the total productivity of the cargo vessels rose by 2.5 percent, in the shipping companies of the eastern basins it dropped by 4.9 percent, and in the entire sector--by 1.7 percent. A particularly large reduction was permitted in the Yenisey River, Ob-Irtysh United, West Siberian and Lena United Shipping Companies. Their directors and operations personnel must pay special attention to increasing the efficiency of transport fleet use in order to fully provide for the ever-increasing demands of the national economy of Siberia and the Far East for river shipping.

One of the main reasons for underfulfillment of the assignments for cargo fleet productivity at most shipping companies is a reduction in the load per ton of dry-cargo tonnage.

The comprehensive program calls for maintaining the loading at the 1980 level for the entire five-year plan. However, the shallow waters in the Lena, Irtysh and Severnaya Dvina Rivers, as well as in the tail races of the Votkinsk and

Gorkiy hydrosystems is responsible for the underloading of the fleet. Along with this, the directors of the operations services of some shipping companies have slackened supervision over the work of the ports and vessel captains with respect to using the maximum carrying capacity permissible for the navigation conditions. With the insufficient degree of increase in the number of large-tonnage vessels, this too has contributed to their underloading. For these reasons, in the last three years, dry-cargo fleet loading dropped by almost 1.5 percent, which reduced total productivity by 1.08 percent. The loading was considerably lower at the Lena, Ob-Irtysh and Volga United, and Kama, Northern and Yenesey Shipping Companies.

The situation became even more complicated in 1984: due to the insufficient depths the loading continued to drop and was reduced, as compared to 1983, by 0.8 percent for dry-cargo vessels and by 2.3 percent for tankers.

In the concluding year of the five-year plan, the operations workers, port workers and railroad men must take specific measures to increase the load. The work of the dredging fleet must be organized so as to ensure absolute maintenance of guaranteed depths under any natural conditions. In conjunction with the enterprises, the USSR Ministry of Power and Electrification should introduce optimum schedules for letting water into the tail races of hydrosystems and increase the efficiency and reliability of depth prediction.

There must be achievement of the goal that all interested personnel, from worker to moorage chief, strive to load the vessels completely, to the permissible draft. The vessel captains have a considerable role in this. Ship crews must have material incentive to use each centimeter of the draft.

Wide-scale publicity must be ensured through the basin newspapers: the experience of the leading workers should become the property of everyone. The dispatcher staff of the shipping companies is obliged to keep constant watch over the loading of the fleet, call the negligent ones strictly to account and actively help the enterprising crews. It should be explained to each captain, cargo area and moorage chief and to the brigade leader of the port workers that large reserves are hidden in the loading of the fleet, and that the success of the 1985 navigational season in many ways depends on how they are utilized.

An extremely important factor affecting the productivity of the cargo vessels is the intensiveness of their processing at the ports and at the moorages of the clientele. The plan specifies increasing, in this five-year plan, the freight processing intensiveness by 16 percent, and in 1983, by 9.6 percent. In 1983, with respect to the dry-cargo fleet, it rose by only 3.2 percent in tons per vessel-day, as compared with the 1980 level. This did not even compensate for the growth in average carrying capacity, which increased by 6.5 percent in this period. As a result, the layovers of the motor ships for freight operations exceeded the estimate by 4.7 percent, and of barges--by 5.8 percent, and the total productivity fell by 0.97 percent.

The intensiveness of the cargo processing for dry-cargo vessels dropped at the Lena and Ob-Irtysh United, Northwestern, Northern, Volga-Don, Kama and Moscow

River Shipping Companies. Nor did the situation improve in 1984: for the dry-cargo fleet the intensiveness rose by only 2.7 percent as against the preceding year.

All the potentials for increasing intensiveness must be realized in the shipping companies and at the ports. There must be more active introduction of a method of concentrating transshipment machines in processing large-tonnage vessels, use of the most efficient gripping devices, advanced flow charts for transshipment and elimination of the causes of unjustified work delays and interruptions. Each port worker must be interested in accelerated processing of the fleet. Special attention should be devoted to this, since the reserves lying in increased intensiveness are commensurate with the reserves to increase the load.

When examining the complex group of problems involved in processing the fleet, it should be noted that, while in three years of the five-year plan the layovers of dry-cargo vessels undergoing cargo operations increased, the idle times of the motor ships awaiting processing were reduced by 2.3 percent, which made it possible to increase total productivity by 0.81 percent.

Considering that the time spent awaiting processing is more than half the time of the cargo operations, it is necessary not only to comply with the vessel-hour norms, but also to increase the number of moorings for simultaneous processing and ensure a smooth work flow for the vessels, according to the schedule.

The traffic schedule was fulfilled by 78.3 percent in 1983, as opposed to 71.9 percent in 1981. Almost every fifth vessel operates with a deviation from the schedule. Moreover, in the West Siberian, White Sea-Onega, Vyatka and Kuban Shipping Companies, schedule fulfillment dropped, and in large shipping companies such as Volgotanker, Volga United and Yenisey, it was lower than the average level for the sector.

Nor did the situation improve in 1984: schedule fulfillment remained at the 1983 level. The dispatcher staff allows instances of sending a fleet for loading without taking into consideration the specific circumstances at the destinations.

In 1985 these reserves must be more fully used, and a considerable reduction achieved in the layovers of the vessels awaiting cargo operations. Above all, the established norms for cargo work must be complied with strictly. It must be remembered that even one vessel delayed for processing may become the primary source of idle times when awaiting processing for all subsequent vessels when they arrive uniformly. In this connection it is very important to ensure an even feed of vessels to the ports. The dispatcher staff should not only fix the vessels' proceeding along the control points and through the lock, but also, when possible, regulate their arrival at the destinations. For this, the sequence of passing through the lock must be corrected and recommendations made to the captains that they take on fuel or foodstuffs at intermediate points or, on the contrary, accelerate the progress. In any case the dispatcher is obliged to explain to the crew the sense and reason for the instructions and recommendations issued. The main thing, however, for ensuring even arrival of the fleet at the destination is to send the vessels off evenly from the loading points, at established intervals.

Before the beginning of the navigational period, each shipping company should analyze in detail the work of the large-load consists, and arrange them on routes, at the ports of which all the vessels of the consist could be processed simultaneously. This rule should be complied with throughout the entire navigational period.

It is difficult to overestimate the effect on total productivity of the cargo flow structure and the average distance of the cargo transshipments. In 1983, the average run for loaded dry-cargo vessels was 8.7 percent less than the estimated value, and at the same time the unladen run increased by 2.2 percent, which reduced total productivity by 0.55 percent. In 1984 the situation worsened: the loaded run decreased by 7.4 percent as opposed to 1983.

The correlations of the interbasin freight flows in fellow shipping companies in the Center and Northwest are deteriorating. In three years the passage of unladen tonnage from the central to the northwestern basins increased 1.6-fold, and in the 1984 navigational period over 3 million tons of unladen tonnage called in at the Northwest. The average distance for transporting dry cargoes for the ministry decreased by 27 kilometers, or by 6 percent as against 1983.

These data attest to the need for a fundamental improvement in work on attracting additional freight flows to river transport, above all to load the empty-run directions. Since the Ministry of Railways refuses to turn over loads with two transshipments to river transport, this work becomes exceedingly important. The shipping companies and planning institutes, however, are not sufficiently concerned with these problems. As a result, the planned cargoes at the Volga-Don, Volga United, Moscow, White Sea-Onega, Ob-Irtysh United, West Siberian and East Siberian Shipping Companies are insufficiently presented for transport.

In the preparatory period for the 1985 navigational season, the directors of the shipping companies must provide a plan for transport with practicable cargoes. Business contacts must be set up with the main consignors and specific measures determined to present the cargoes. Particular attention should be devoted to the freight flows, the guarantee of which raises doubts. At the same time, it is very important to seek additional freight flows to load the empty-run routes. The planning institutes and TsNIIEVT [Central Scientific Research Institute of Economics and Operation of Water Transportation] should render great assistance in this matter to the shipping companies. It should particularly be emphasized that, unless additional long-run cargoes are attracted and the freight flows along the routes improved, it is practically impossible to improve the operation of the transport fleet.

Large reserves for improving the use of the fleet lie in reducing time input in passing through locks, taking on fuel, forming the consists and in layovers for elemental and other reasons.

In 1984 most of the lock systems carried out the vessel passage in accordance with the norms, but at the Gorodets locks over 7 million tonnage-days above the norm were spent in waiting for passable depths.

The shipping companies and the basin administrations of the route (canals) should continue to improve the lock organization for the fleet, and in 1985 cut the time consumed for this operation.

The work of the Gorodets locks should be analyzed in detail so that in the coming navigational period all the shortcomings are taken into account and eliminated.

Every year the idle times for vessels when taking on fuel increase. The established practice of issuing a limited amount of fuel and lubricants forces the crew to fill the bunkers repeatedly during a run, losing operating time. The supply workers of Volgotanker and others who bunker vessels must abandon the formal principles of its organization and find a solution which would make it possible to return to the situation when the crew obtained fuel for the full round trip, and bunkered where it was economically advantageous. This is necessary, since various types of fleet spend from 2 to 5 percent of the time of all the layovers in taking on fuel.

The layovers for making up consists, waiting for towing and for other reasons are not being reduced. The operations personnel of the shipping companies do not pay proper attention to reducing them, considering this work of secondary importance. Meanwhile, over 34 percent of the time for all layovers of dry-cargo tonnage is spent for these operations.

In three years of the five-year plan the layovers for freighters for meteorological reasons increased by 7.8 percent and reached 9.2 percent of the total time input. Their increase was caused by the yearly prolongation of the fleet's period of work under ice conditions. The vessels accumulate in the sections with heavy ice, awaiting the ice breakers' passage, since the insufficient number of line ice breakers makes it impossible to organize their uninterrupted passage. In spring of 1984 alone the layovers of vessels awaiting ice breaker passage increased by 6.2 million tonnage-days as against 1983.

The task of the operations personnel at the shipping companies lies in regulating the vessels' going out onto the main routes. The number of them at each complex ice section should correspond to the possibilities of the ice breakers available here. At the same time, the transshipment volumes must be determined on the basis of the technical and operating conditions and not the practice of planning, with the growth from the base achieved.

The unfavorable situation has also grown more complex with the use of tugboat towing. While in 1983 the productivity of the freighters increased somewhat as compared with the 1980 level, it was reduced with respect to towing, particularly in the Yenisey, Northwestern, Ob-Irtysh United, Northern and Belaya Shipping Companies.

Nor did the situation improve in 1984. A reduction in the rate of traffic of the loaded consists, increase in the layover time while awaiting their formation, when taking fuel and passing through locks and the growing time input on empty runs and maneuvering and auxiliary operations served as the reasons for this.

The directors of the operations services at the shipping companies do not properly supervise the work of the tugboat fleet, and as a result their use indicators are getting worse, overexpenditure of resources is noted, the cost of transshipment rises and labor productivity goes down.

Some operations personnel underestimate such an advanced method of work as operating large-load consists. The assignment for freight turnover in 1984 was not fulfilled by these consists, and the output per pusher tug was not increased. There must be a considerable rise in the level of dispatcher direction of this fleet, and its work must be more frequently analyzed and critically evaluated. It is intolerable that powerful pusher tugs are idle for a long time at their consists, as at the Tomsk Port in 1984.

A considerable increase in the productivity of the freight and tug fleet should form the basis for drawing up the operations plans at the shipping companies in 1985. Measures must be taken to reduce the duration of the turnovers, comply with the norms established and strictly observe the traffic schedule. When the vessels are arranged according to routes, their most efficient use must be taken into consideration, as well as specific circumstances.

The scientists' work in the sphere of long-range improvement of the operations activity should be stimulated. A comprehensive program for increasing the use efficiency of the transport fleet should be given in detail for the period up to 1990. TsNIIEVT, in conjunction with the shipping companies, should determine the basic directions and scale of the estimated assignments for each element of the transport process. These assignments should correspond to the development of the material-technical base and to the introduction of advanced work technology and achievements of the leading crews in the fleet.

The institutes must broaden scientific research on operations work, increase research work on the theory of regulation and evenness of the fleet's movement, in conjunction with the VTs [computer center] accelerate work on automating control of the transport process using electronic computers, and stimulate the development of more efficient indicators of fleet use.

Regulation of the transport process should have a sound scientific basis, and practical methods must be worked out to ensure the vessels' evenly spaced arrival for processing under the specific conditions formed. All river transport units need a flexible system for uninterrupted planning of interconnected work.

The electronic computer is of great significance in solving this problem. The first section of an automated subsystem to calculate the navigation plan for use of the fleet, developed by GIIVT [Gorkiy Institute of Water Transportation Engineers], should be put into operation. Improvement of the subsystem, "Regulating Interbasin Transport", on which the GVTs [main computer center] is working in conjunction with TsNIIEVT, should be continued. It will aid in more precisely coordinating the work of the shipping companies and will reduce the fleet's idle times when awaiting processing.

The present indicators of total productivity do not fully meet today's demands, do not take into consideration the growth of the average carrying capacity of the fleet, do not differentiate the constituent elements with respect to functional directions and do not reflect the development of transport along small rivers and in a prolonged navigational period. For example, in three years of the five-year plan the total productivity of the dry-cargo fleet increased by only 0.4 percent, the productivity of a single vessel increased by 6.7 percent, and the yearly yield from a physical ton of tonnage taking part in the transport--by 3.1 percent. Each of the indicators mentioned has its own merits and shortcomings, and the task of the institutes lies in finding an indicator that objectively reflects the fleet's work and constantly stimulates an increase in the transport volume.

In the 1985 navigational period, all the river transport personnel connected with fleet operations have to improve considerably work on realizing the existing reserves, so as to ensure unconditional fulfillment of the assignments of the concluding year of the five-year plan.

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MARITIME AND RIVER FLEETS

CHIEF ON HISTORY OF CASPIAN SHIPPING COMPANY

Moscow MORSKOY FLOT in Russian No 2, Feb 85 pp 22-27

[Article by D. Gashumov, chief of the Caspian Shipping Company: "Our Calendar: The Caspian Shipping Company - 125 Years Old"]

[Excerpts] Shipping on the Caspian Sea has a long history. Stone anchors that look like millstones, found underwater near Cape Byandovan to the north of Apsheron, are not the only proof of that. Acccording to the evidence of written sources, harbor dues were collected here from seafarers in the Middle Ages.

Seafaring trade on the Caspian developed from the first half of the nineteenth century with the entry of Azerbaijan into Russia. This historic event had great significance for the social-economic, political, and cultural life of the region. The first steamship appeared on the Caspian in 1846.

The postwar development of the shipping company fleet and its repair facilities was put into effect in full conformity with the economic targets. In 1946, 26 vessels were added to the dry-cargo fleet, among them the steamships "30 Let VLSKM," "Nizami," "Chorokh," and "Andaga." The oil-transport vessels "Kapitan Plaushevskiy," "Nargen," "Amburan," and others were commissioned. The beginning of shipbuilding at shipping company enterprises also dates from that time. In 1945 the tug "Burnyy," the first output of the Plant imeni Vano Sturua, was given over into operation.

In 1953 the Kasptanker and Kaspflot Shipping Companies united into a single Caspian Shipping Company, into whose complement the former coastal shipping company Reydtanker (Astrakhan) also entered in 1961. The formation of a single Caspian Shipping Company was greatly conducive to the further improvement of operational control of the fleet and its more rational utilization. In the same year, the fleet began to be replenished by vessels of domestic and foreign construction.

Commissioned were the 1,100-ton capacity tankers "Karadag," "Ukhta," and "Chardzhou" and the dry-cargo "Tissa"-class vessels "Tselinogran," "Pavlik Morozov," "Akhtuba," "Shongar," and others, with a deadweight of 1,133 tons.

The entry into operation of the shallow-draft tankers of the "Oleg Koshevoy" and "Inzhener A. Pustoshk ." classes was a large step in the development of technical progress in the oil-transport fleet. It became possible to transport petroleum products from Baku to Astrakhan without transshipment in ocean roads, and the productivity of the tanker fleet grew while the cost of shipment decreased. Overall automation was first put into practice on the tanker "Inzhener A. Pustoshkin," with a decrease in the crew size from 32 to 23 men and an increase in the productivity of labor of up to 40 percent.

In 1959, the Caspian Shipping Company began to receive shallow-draft dry-cargo ships of the "Inzhener Belov" class (cotton/timber ships) with a deadweight of 4,016 tons. These vessels initiated the shipments of cargos from the Caspian to the upper Volga without their transshipment in Astrakhan. The Caspian Shipping Company received 18 such vessels before the end of the Seven-Year Plan, the targets of which were fulfilled ahead of schedule - in 1964. During these years the shipping company also received the tugs "Smelyy," "Dzhambul," "Revolyutsioner," "Ashug Staliskiy," "Boyevoy," "Ot radnyy," and "Otvazhnyy," and the coastal-class "Aleksandr Nevskiy" and others. The support fleet was complemented by the vessels "Turali," "Beloye More," and others.

In the development of maritime communications of the basin in the postwar period, the Baku-Neftyanyye Kamni line was created; and in the late 1940's they began to extract oil which was then loaded on tankers in all weather from an unequipped berth--a steel breakwater. This line, with a day's roundtrip for vessels, was called the "academy of mooring operations." All basin records for the utilization of vessel transport capacity on the line were broken by the ten-thousand ton "Azi Aslanov," providing annual transport of over three million tons of crude oil.

In 1962 the Baku-Krasnovodsk ocean-going railroad ferry crossing, the first in the country and the largest in Europe at that time, was commissioned. Five diesel-electric ferries of the "Sovetskiy Azerbaydzhan" class formed a "floating bridge," which shortened the way from the Caucausus to Central Asia, Kazakhstan and back by hundreds of kilometers. The shore berthing structures of the Caspian crossing were built in Bektash and Aktau. Aktau, the new port on Mangyshlak, was built with the active participation of the transport fleet of the Caspian Shipping Company, because before the construction of the line Mangyshlak Station, to Makat Station, bulk cargos went only by sea. In the current five-year plan, the ferry crossings on the Caspian are beginning to be replenished by new vessels. They are built at the Yugoslavian "Ul'yanik" Shipyard. The lead ferry of the series, the "Sovetskiy Dagestan," arrived in the basin in 1983.

For the first time the shipping company fleet has begun to be replenished with RO-RO ships built by the shipyard workers of the GDR in Rostock.

In the 10th and 11th Five-Year Plans, there entered the transport fleet of the shipping company five of the "Nikofor Rogov"-class tankers with a deadweight of 12,000 tons, ten "Kishinev"-class and eleven "Voznesensk"-class dry-cargo vessels. The shipping company continues to be supplied with new "Oleg Koshevoy"-class tankers with a cargo capacity of 4,600 tons.

On the eve of 1961 some of the vessels of the Caspian Shipping Company began to open up new lines beyond the boundaries of the basin. The new tankers "Gyurgyan," "Neftechala," "Udzhary," "Dzhebrail," and "Nebit-Dag" were sent on long-range voyages. In 1962 the Caspian workers transported more than 200,000 tons of petroleum products to the ports of seven foreign countries. The following year Caspian ships called at 35 ports in 16 foreign countries, and still one year later an experimental cruise was made by the ship "Kubatly," under the command of Captain V. Kononov, with through cargo from the Iranian port of Naushahr on the Caspian to Szezecin.

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MARITIME AND RIVER FLEETS

ACHIEVEMENTS, PROBLEMS OF PRIMORYE SHIPPING COMPANY

Moscow MORSKOY FLOT in Russian No 2, Feb 85 pp 12-15

[Article by Yu. Merinov, deputy chief of the Transportation and Communications Department of the Primorye CPSU Kray Committee: "Management and Economics--The Primorye Shipping Company: Successes, Problems"]

[Text] The labor force of the Primorye Shipping Company measures its history from January 1972, when the Oil Transport Fleet Administration of the Far Eastern Shipping Company was reorganized into a independent shipping company, the 4th maritime transport enterprise in the Far East and the 17th in the maritime fleet system.

The formation of the basin tanker fleet made it possible to more rationally and expeditiously plan and execute the supplying of petroleum products to numerous consumers in the rapidly-developing regions of the Primorye Kray, Sakhalin, Magadan and Kamchatka Oblasts, and the individual enterprises of the Far North and East Chukotka, as well as to satisfy the demand for fuel of the "Dal'ryba" All-Union Association fishing fleet and to support foreign-trade shipments at the required level.

In these years the Nakhodka oil-handling port went into operation, a technical maintenance facility for the fleet has been equipped, the supply and maintenance subdivisions of the shipping company are being developed and expanded, individual housing is being created, and social and cultural living projects are being built. But most importantly, the officer corps and rank-and-file complement of the fleet are being fully staffed and a management apparatus is being created, dedicated to the solving of a diverse group of questions facing the shipping company.

In 1977, for the first time in the sector, the Nakhodka inter-sector oil transshipping center was created, into which entered the Primorye Shipping Company, the Vladivostok Division of the Far Eastern Railroad and the Primorye Administration of Gosnefteprodukt [State Petroleum Products Committee]. In the last five-year plan alone, the co-ordinated work of the partners in overall competition made it possible to increase the shipment of petroleum products by sea by more than 20 percent, to raise the productivity of fleet operation and to shorten transport idle time in cargo operations. The center's operational experience was demonstrated at the Exhibition of Achievements of the National

Economy of the USSR. In 1979 the shipping company organized direct passage on the Magadan main route. This allowed a more than 3 percent shortening of tanker idle time, assuring a saving of 10,000 rubles on each run. The work on scheduling made it possible to more fully satisfy the growing demands of the enterprises of the Magadan Oblast for petroleum products with less application of tonnage.

In the labor history of the shipping company labor force, many pages are written about the selfless labor of the sailors and shore enterprise workers. The pride of the shipping company are the vessels that bear on their sides names, associated with the name of the founder of our party and state - Vladimir Il'ich Lenin: the tankers "Leninskoye Znamya," "Zavety Il'icha," and "Pamyat' Lenina." They were repeatedly the leaders of competition not only in the shipping company, but in the basin, constantly attaining high productivity indicators. On the sides of eight tankers are the names of pioneer-captains of the Soviet maritime fleet in the Far East, whose long working careers serve even today as an example for young sailors.

A lofty appraisal of the work of the shipping company laborers is the awarding of medals and orders of the USSR to 130 of its workers, and senior mechanic Spartak Georgiyevich Pirogov was awarded the high title of Hero of Socialist Labor.

The fraternal aid to the nation of Vietnam was a shining page in the history of the shipping company. During the period of American imperialist aggression, the "bridge of friendship" - the ports of Primorye to Vietnam - operated continuously. A multitude of heroic runs under fire, demonstrating courage and fearlessness, were made by the crews of the shipping company's vessels. Individual tankers and nearly 100 sailors were awarded high decorations of the Democratic Republic of Vietnam.

The names of outstanding workers and innovators of production are well known far beyond the borders of the shipping company. Largely thanks to their efforts, the shipping company handles its plan targets and socialist obligations Cargos are delivered to the Eastern Arctic region and to Chukotka in full quantity and in the prescribed assortment. The delivery of cargos is effected smoothly to Magadan and Sakhalin Oblasts, to the enterprises of the Primorye Kray and to fishing expeditions.

It is impossible to say, however, that all questions are resolved and problems do not exist in the shipping company. The results of its operational, organizational and party-political work testify to many serious shortcomings and omissions. For example, the volume of cargo shipped in 1983 declined 4.5 percent in comparison with 1981. The shortfall from control targets of the five-year plan over three years exceeded 270,000 tons. Over this period the average daily gross rate of cargo loadings fell by 2.5 percent, and the labor productivity plan was only 98 percent fulfilled.

During the years of the 11th Five-Year Plan, idle time of tonnage awaiting cargo increased. In comparison with the corresponding period of the 10th Five-Year Plan, it increased by 22.6 percent and totalled more than 26 million

ton-days, which is equal to a loss of profit of more than 12 million rubles. As shown by analysis, the basic causes of fleet idle time lie in the absence of the meshing of plans between the partners in overall competition. It cannot be considered normal, when the railroad station and the Primorye Division of Glavneftesnab [The Main Administration for the Transportation and Supply of Petroleum and Petroleum Products] fulfill their plans, but the vessels of the shipping company are idle awaiting cargo. This, naturally, leads to the worsening of the plan indicators of tanker operation.

Such a state of affairs has been observed for many years. This question can only be resolved on the level of the ministries and departments concerned. The co-ordination of plans should begin on this level.

Still another fact: due to breakdowns, damage repair and delays, the losses just for four vessels under repair ("Vilnyuysk," "Anyuy," "Yegor'evsk," and "Pamyat' Lenina") amounted to nearly one million ton-days. All of this indicates how great the reserves are for the raising of the fleet's operating efficiency.

Miscalculations in the operating activity of the Primorye Shipping Company led to the fact that during certain periods, the planned supplies of petroleum products to enterprises and organizations of the Far East region were disrupted, which interfered with the smooth operation of the enterprises, their fulfillment of state plans, and the assurance of a normal day-to-day life for the population.

The accident situation in the shipping company arouses great anxiety at the kray Party committee. It is much higher than overall in the Ministry of the Maritime Fleet. Serious accidents, including the loss of vessels, demonstrate the irresponsibility of the officers of the vessels and the managers of shore services and shipping company departments, and the weak attention of Party organizations to questions of management.

Moreover, very often the measures taken do not lead to the desired result. Accidents and emergency situations continue. After the loss of the tanker "Khanka," when the ship suffered a collision that was the fault of the senior assistant captain who fell asleep while on watch, orders were issued, measures were developed and meetings were held. But two years later an identical incident occurred with the tanker "Ambarchik." These facts also testify to the lowering of accountability of fleet and shore managers and weak inquiry into the overall state of affairs.

The state of labor and social discipline in the shipping company has considerably worsened in the current five-year plan, especially among the members of the officer corps - practically every other violation is committed by production commanders. The numbers escorted to the medical sobering-up unit has doubled, and every third violation is committed in an intoxicated state. The shipping company is procrastinating in reorganizing its operation in light of the law passed "Concerning Labor Collectives and Their Role in the Management of Enterprises, Institutions and Organizations" and is not making use of the opportunities presented to it.

Serious miscalculations in personnel work adversely affect the general level of operations. Over the last three years the number of international-voyage sailors dismissed is 3.5 times greater than the number admitted. Currently, practically every other sailor has worked in the shipping company for less than five years. There are shortcomings in retaining young specialists in production: almost 30 percent of them are dismissed without having worked the prescribed period. In connection with the personnel turnover among specialists, there is essentially no effective reserve in the shipping company for acting managers, work on creating one is weakly carried out, and there is a failure to fulfill the requirement of the kray Party committee and the Ministry of the Maritime Fleet for the promotion of only specialists of the maritime fleet to the duties of captain's first assistant. Every third captain's first assistant entering the shipping company in recent years had no maritime education and was not familiar with the specific character of maritime transport and shipping company traditions. All of this adversely affects the general level of ideological and party-political work. A great quantity of measures are carried out on the vessels, at times several measures in a day; however, their organization and effectiveness is low. The resulting state of affairs indicates the necessity of decisive change in the style and methods of management work, Party and trade-union committees and other social organizations. It is necessary to constantly strive for the correct combination of trust and respect toward the personnel keeping a high level of demandingness toward them, to give timely and due account of serious negligence in social-political and educational activity and to hold responsible individuals strictly accountable for the overall state of affairs.

In the 11th Five-Year Plan the members of the Primorye Shipping Company will have to increase cargo traffic by 8-9 percent. But the fulfillment of these targets is problematic. The first three years of the 11th Five-Year Plan, the shipping company's yearly plans were lowered below the 1980 level, and only in 1984 was growth envisaged of 0.6 percent in comparison with that achieved in the 10th Five-Year Plan. In the resulting situation, it is excessively difficult for the vessel crews to take on heightened socialist obligations and to mobilize the labor force toward their resolution.

The technical state of the tanker fleet also gives rise to serious concern. Write-off and replenishment programs are not being fulfilled. Of four projected tankers with a total cargo capacity of 21,600 tons, only one was received in 1983, and one more in the first half of 1984. As a result of this, last year alone more than 300,000 tons of projected cargo for transport was not shipped. Most of this amount is accounted for by Okhotsk shore points, East Kamchatka, the Kuril Islands, several regions of Primorye and various fishing industry expeditions. The timely and full provision of petroleum products to the regions of the Far North in the Arctic navigation period gives rise to serious difficulties. Today, "Internatsional"-class tankers (average age 15 years) must be sent into the Arctic, and sometimes even "Aksay" (20 years) and "Kazakh" (24 years) class vessels. Arctic navigation of 1983 demonstrated that for the harsh conditions of the North, the fleet should be strong and reliable. The difficulties associated with the use of old vessels will grow with every year. Unfortunately, it is clear even today that the necessary fleet arrivals will not occur in the current five-year plan. The kray Party committee and the Primorye Shipping Company have repeatedly turned to the Ministry of the Maritime

Fleet with the request to review the replenishment plan of the oil-transport fleet in the Far Eastern basin; however, up to the present time the problem remains unresolved.

The insufficient traffic capacity of the oil-handling facilities of Goskomnefteprodukt in Primorye Kray, as well as the Sakhalin and Kamchatka Oblasts and in East Chukotka gives rise to serious concern. The volume of transport on these lines grows from year to year, but the tank park and production lines of the oil tank plant have essentially remained as before. The lead Nakhodka oil tank plant has difficulty coping with the growing volumes of petroleum products handling.

As before, the shipping company is experiencing great difficulties with questions of maintenance and fleet repair, and in connection with considerable vessel ice damage received in 1983 in Arctic navigation these difficulties have grown even greater. The absence of its own vessel repair facilities is a fundamental cause of the constant budget overruns in repair time and the worsening technical condition of the tankers.

The construction of housing and social and cultural living projects remains an acute problem in the shipping company. Practically every third shipping company worker is on a waiting list to receive living space. The housing situation is even worse for the young specialists, the overwhelming majority of whom have no apartments at all and are registered by shipping company. The overall total of capital investment started up by the builders of Nakhodka last year was only 85.6 percent, and more than 5,000 square meters of living space was not commissioned in that period. There are many causes here, but the main one is the low capacity of the construction industry base. Major enterprises of the Ministry of the Maritime Fleet system are located in Nakhodka. And all of them are suffering from an acute need for housing. It would have been correct if, on the example of the fishing enterprises in Nakhodka, a frame-and-panel housebuilding plant had been built for the maritime fleet. This would have allowed the situation to be substantially improved in the near future.

The Primorye Shipping Company is the only industrial enterprise in the city that does not have sports facilities and cultural-enlightenment and public health institutions. All of this adversely affects the fitness of the personnel.

The practice of sending young specialists from educational institutions in the western part of the country to the shipping company also demands serious review. Only 25 percent of them are retained in the shipping company. It is advisable to consider the question of training the specialists for the tanker fleet at the facilities of the educational institutions of the Far East.

We understand very well that all of these questions cannot be solved in a short time, but an overall development program for the Primorye Shipping Company for the next 10-15 years is needed. This would allow the timely and full provision of cargos to the rapidly developing regions of the Far East and the Far North.

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CARGO FLOW PROBLEMS ON WATERWAYS OF SOVIET NORTHWEST

Moscow RECHNOY TRANSPORT in Russian No 12, Dec 84 p 9

[Article by P. Olenev, department chief in the Freight Main Administration of the Ministry of the River Fleet: "Attract Cargoes to the Northwest"]

[Text] In the last few years there has been a considerable increase in the freight flow of mineral-building materials, grain cargoes, metal, hardware, timber cargoes and equipment from the boundaries of the Northwestern Shipping Company to the Volga, Moscow and in other directions.

The Volga-Baltic Waterway Administration makes possible a yearly increase in the volumes of transit cargo transport from the northwestern regions and from the countries of the Baltic and North seas to the shipping companies of the central basins. This has led to the fact that the ratio of the vessel flows--loaded from the Northwest and empty to the Northwest--is worsening from year to year. In 1982 it was 43.7 percent, but in 1983--only 27 percent.

The Collegium of the Ministry of the River Fleet, in September 1984, heard directors from the Northwestern Shipping Company and Lengiprorechtrans speak on seeking new freight flows in the northwestern direction. These organizations were set the task of improving the purposeful work to attract incoming cargoes.

Work with the consigners and receivers shows that today there are cargoes, as, for example, slag from the Cherepovets Metallurgical Plant, that can considerably rectify the situation concerning loading vessels that have an empty run to the Northwest. Tens of millions of tons of valuable material, needed for road construction, are lying in the dumping grounds of this enterprise. No large capital investments are required to ship it. It is sufficient to supply an excavator, bulldozer and a few motor vehicles to take it to the waterline, and the vessels can be loaded by floating crane at an unequipped shore.

In 1984, development of this freight flow was begun. The plant concluded an agreement on supplying Lenavtodor, by river transport, 300,000 tons of waste slag. But the necessary organizational work for its shipment has not been done by either the metallurgical plant or the Cherepovets Port.

Waste slag is taken to an unequipped berth 7-8 kilometers away, directly from the open-hearth and blast furnace shops, sometimes when hot, littered with metal scrap and sinter "pigs" of one meter and more, which cannot be transferred by a grab for loose cargoes. Because of the poor condition of the slag, Lenavtodor refused to take it. As a result, only about 100,000 tons of this cargo were shipped in the navigational period.

The shipping company and the port, in conjunction with the shipper and the receiver, must solve all the problems of preparing the slag, organizing its transport to the mooring and loading it on the vessels to achieve shipments of at least 300,000 tons of slag on the average in the navigational period.

Pyrite cinders may also be sent to the boundaries of the Northwestern Shipping Company from the Ammofos Production Association, where the dump heaps contain about 10 million tons of this raw material, needed for cement enterprises. The association has agreed to construct a berth to ship it by river transport. The problem of a further increase in the volume of shipping complete fertilizers by the river fleet to water ports must also be solved with the association.

Lengiprorechtrans should investigate the expediency of shipping, beginning with the 1985 navigational period, Kuznetsk coal for the Arkhangelsk Paper Combine, with the first transshipment through Perm instead of Kotlas. This will make it possible to load the vessels on the Perm-Cherepovets route and the Kola iron ore concentrate freed fleet on the Kandalaksha-Cherepovets route.

Maintenance of the flow of Pechora coal for the Kirovskaya GRES [state regional electric power plant], with transshipment through the Cherepovets Port must be substantiated and achieved.

One of the ways to increase the fleet's load in the northwestern direction is to accelerate the construction and start of operation of the Vazhina Port on the Svir River. In practice this will be the only transshipping complex of the Ministry of the River Fleet in the Northwest. The shipping company and institute must solve many problems connected with determining the expedient freight flows through this port, including the technology for developing them.

First of all, transshipment of fusing agents from the Belorucheyskiy and Novolipetskiy quarries to Kostomuksha and other metallurgical enterprises must be provided for, as well as transshipment of Kuznetsk coal for the electric power stations of Lenenergo and other sectors of industry in Leningrad and Novgorod Oblasts and in Karelia, especially for the Kondopoga Pulp and Paper Combine.

In the next few years there will be an increase in the outflow of cargoes from the boundaries of the White Sea-Onega Shipping Company. When the mechanized pier at the Cherepovets Metallurgical Plant is put into operation there will be up to a 2.5 million ton increase in the receipt of Kola iron ore concentrate.

The first section of the Bol'shoy Massiv quarry in the Karelian ASSR, with an initial river transport shipment of 750,000 tons of stone-rubble products, and with the shipment volume subsequently being brought to 3 million tons, will also be put into operation.

Therefore, work on increasing the freight flows to the Northwest is becoming even more necessary. Construction of a large transshipment port on Lake Onega will possibly be required to solve this problem.

The Northwestern and White Sea-Onega Shipping Companies and Lengiprorechtrans have many problems which must be solved right now. Only purposeful work, conforming to plan, in collaboration with other institutes and shipping companies, can give the necessary effect.

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MARITIME AND RIVER FLEETS

PLANS FOR DNEPR-BUG LOCKS; EFFECTS ON NAVIGATION

Moscow MORSKOY FLOT in Russian No 2, Feb 85 pp 39-40

[Article by V. Dyba, chief navigator of the Black Sea Shipping Company, and V. Kuleshov, chief specialist of Chernomorniiproyekt [Black Sea Scientific Research and Planning Institute]: "The Dnepr-Bug Hydrosystem"]

[Text] In connection with measures to improve water provision to the population and national economy of the Ukrainian SSR, it has been outlined that the Dnepr estuary be dammed and the Dnepr-Bug Hydrosystem (DBG) be constructed near the city of Ochakov in Nikolayev Oblast. Navigation passes, spillway, ice passes and other structures are to be included in the hydrosystem.

The navigation passes, designed to pass all vessels through to the Dnepr-Bug, Nikolayev, Kherson ports and back again, consist of two shipping locks, a large navigation opening and jetty-piers adjacent to them. The dimensions of the water approaches and operational water areas correspond to the existing requirements to ensure navigation safety. Navigation equipment devices will be placed at the approaches and structures of the hydrosystem.

Navigation lock No 1, with retractable gates, designed to pass through all river and some sea-going vessels, will be constructed near Cape Ochakovskiy. The jetty-piers adjacent to it ensure the mooring of two ships of the type "50-letiye Komsomola" from the marine side and from the estuary side. All the river vessels pass through the lock independently. The marine vessel passage will be implemented by means of trolley-tows, moving along one side of the jetty.

Navigation lock No 2, with retractable gates, designed to pass marine vessels through, will be constructed south of Lock No 1. A spillway dam will be erected between the locks. The jetty-piers adjacent to the lock on the marine side and on the estuary side will ensure mooring for two vessels of the "Zoya Kosmodem'yanskaya" type. Passage is specified by means of trolley-tows, moving along one side of the pier. The large navigation opening (BSO) specified has a cement gate and is designed to pass through vessels awaiting their turn, and also during repair of one of the navigation locks. Due, however, to the possibility of increasing the existing difference between the head races and tail races and the number of vessel passages, and to ensure safe conduct

for the vessels under unfavorable hydrometeorological conditions, it appears expedient to reequip the large navigation opening in the third navigation lock. The BSO and lock No 2 have common jetty-piers, along the sides of which vessel passage is provided by means of trolley-tow.

The technique for conducting the vessels through the locks consists of the following. The vessel passing through the lock is moored near the working section of the jetty-pier and provides the necessary hawsers for the bollards installed. The two trolley-tows that have approached bear up against a rectractable mooring beam in the cylindrical section of the vessel, and cables are fed from automatic mooring winches to the vessel's bitts. Then the trolley-tows lead the vessel through the lock and moor it at the opposite end of the pier. After this the vessel leaves the pier with the aid of tugs and proceeds as assigned.

Under normal weather conditions, the vessel passage presents no particular difficulties. With strong cross winds, the vessel passage, particularly when in ballast, will be made more difficult even with the aid of trolley-tows. Since the structures are about 4 meters high, the vessels passing through the navigation structures will be subject to the action of the prevailing winds from the north, northeast, southwest and northwest. To protect the operational water areas and locks from waves, protective jetties are specified from the estuary side, and an attempt is being made on the marine side to lengthen the Kinburnskaya Kosa [sand spit].

It will be considerably complicated to pass vessels through the DBG locks in winter under icy conditions. Experience in operating existing navigation locks in the Soviet Union, including the cascade of the Dnepr reservoirs, cannot be used to the full extent, especially as they were designed and constructed without taking into consideration the possibilities of their winter operation. However, measures carried out to extend navigation through the existing locks in our country must be taken into consideration.

According to the conclusion of specialists from Chernomorniiproyekt, after the estuary is dammed, there will be some easing of the ice conditions from the marine side, and sharpening of them from the estuary side. The period of solid ice in mild winters will increase to 60-70 days a year. With freeze-up and the action of gale winds from the northeast and east, the ice will hummock in front of the dam in 72 percent of the winters, with clogging of the "cross section" of the navigation canal. Even in mild winters, the ice can reach a thickness of 2 meters and over, due to the congealed "inflows" at the dam. The salinity of the water will decrease and the strength of the ice and its resistance to breaking will increase. The time needed to clear the ice from the estuary will increase, since there will be a considerable reduction in its being carried out to the sea due to the effect of flow and wind.

It was also noted at the meeting of the section on navigation and navigation safety of the Black Sea Shipping Company that in severe and even in mild winters, which alternate in a random fashion, navigation may close down on the average for up to 60 days a year due to the "cross section" of the navigation canal being clogged with ice. In addition to the two ice breakers

specified, it was suggested that a number of additional measures be carried out for safe passage of the vessels in the winter. The proposals made concerning the ice conditions after damming the estuary were based on many years of practical experience of the captains of vessels sailing in this region. In tne opinion of captain-masters, vessel captains, line pilots and specialists from planning and other organizations who attended the section meeting, damming the Dnepr estuary with three navigation structures will become a serious obstacle for navigation particularly in the winter, under icy conditions.

The specialists also feel that after the estuary is dammed, under the condition of reducing the winter throughput from the Kakhovskiy Reservoir and reducing the estuary waters' salinity, its iciness may somewhat increase. At the same time, reducing the exchange of the estuary with the sea water will improve the conditions due to a reduction in the rate of flow in the estuary. However, an increase in the iciness of the estuary will make it difficult to break up the ice due to the wind action. Also, taking into consideration the fact that winds directed toward and from the dam in winter are in practice equally probable, the conclusion arises that the ice conditions of the Dnepr estuary after its damming will not be complicated from the navigation standpoint. Nevertheless, the dangers to navigators in connection with ice hummocking and the formation of closures in the lock area are not without foundation, but shutting down navigation due to this for up to 60 days a year need not be anticipated.

Some specialists assume that the ice conditions after damming the estuary will grow complicated. The maximum thickness of the ice covering can reach 1 meter with the average magnitude in the order of 60 centimeters. Taking into consideration the negligible depths in the estuary, this situation will make vessel navigation through the Bug-Dnepr-Estuary canal difficult.

Despite the varying opinions, all the specialists unanimously come to the conclusion that model studies should be made of the dynamics of the currents in the Dnepr estuary after its damming, when there is a broken ice cover on it. These studies will help to devise special measures to ensure navigation safety in the Dnepr estuary in winter.

In solving the great problems facing the maritime fleet to ensure national economic and foreign trade shipments, the ports of the northwestern region of the Black Sea play a considerable role, including those located at the mouth of the Southern Bug and Dnepr rivers. Therefore, the problem of ensuring navigation safety and the uninterrupted work of such major maritime ports as Nikolayev, Kherson and Dnepr-Bug should draw the attention of experienced specialists of the maritime fleet.

12151
CSO: 1829/196

YUGOSLAV-BUILT TANKER 'I. BROZ TITO' PROFILED

Moscow MORSKOY FLOT in Russian No 2, Feb 85 pp 42-46

[Article by E. Frik, Mortekhsudoremprom All-Union Association, and V. Fomenko, Leningrad TsPKB [Central Planning and Design Bureau]: "The Tanker 'I. Broz Tito'"]

[Text] The leading oil and oil product carrier 'I. Broz Tito' was turned over to the Ministry of the Maritime Fleet at the Split berth in Yugoslavia. The tanker is designed to transport petroleum and petroleum products of four different kinds. With respect to structure it is a fully welded, single deck, single screw vessel with forecastle and aftercastle, with engine room and superstructure for accomodations in the stern and with a bulbous bow, bow thruster and transom stern.

The dead weight of 16,400 tons is ensured when the side ballast tanks are filled with cargo.

The vessel was built for the USSR Register of Shipping Class KM ⊛L 2 A1 (bulk oil) and satisfies the international conventions SOLAS-74 with the 1978 record and MARPOL-73/78, the requirements of the International Association of Oil Companies for tanker manifolds, the sanitation regulations and rules of labor safety techniques, as well as the regulations for passage through the Suez, Panama and Kiel canals, the rules of navigation in the Gulf of St. Lawrence and others.

Two flat, longitudinal bulkheads are placed in the cargo tank area. Together with the corrugated transverse bulkheads, they divide the cargo section of the vessel into 6 central and 10 side (5 on each side) tanks. There are also two settling tanks. There is double bottom plating in the areas of the cargo tanks and the engine room.

The interior surfaces of the cargo tanks are protected against corrosion by epoxy paint from the Adriakolor firm, under license from the Sigma firm, with the coating 250 micrometers thick. Each cargo tank is equipped with its own pump with a maximum feed of 250 cubic meters per hour. The cargo pumps type SK 150, vertical and immersion with hydraulic drive are produced by the Eureka firm (Norway). The pumps are controlled from the centeral freight operations control station (PUGO).

The cargo system is capable of processing four types of cargo simultaneously. The maximum productivity of the system is 3000 cubic meters per hour. To warm the cargo, 16 horizontal steam heaters are installed on the deck, and the cargo is pumped through them by the cargo pumps. With an outside air temperature of -25°C and water temperature of -2°C, the cargo is heated from 25 to 65°C in 8 days.

The heaters are calculated to warm cargo with a viscosity of 3500 from Redvud 1 at 100°F.

The drives for the cargo and ballast pumps are hydraulic motors, fed from special hydrostations installed in separate soundproof facilities in the engine room.

The cargo is taken on through the cargo pumps, and it is possible to receive and unload cargo from the stern.

Measuring instruments and equipment are located in the PUGO for remote control of the loading and unloading operations and ballasting and washing the tanks. A radar system type SUM-21, using microprocessors produced by the ACEA firm (Sweden) are installed to measure the cargo level on the vessel.

The vessel is equipped with systems to measure temperature in the tanks, type Bergan (United States-produced), to measure the pressure in the cargo pipelines, type ATM (produced by SFRYu [Socialist Federated Republic of Yugoslavia]) and with a mimic panel indicating the location of the valves. The valve control hydrostation is installed in the PUGO and consists of two pumps.

Portable washing machines are used to wash the tanks. Th· dirty water from the washing is directed to the settling tank, from which, after separation, it is sent to the second settling tank, where it is also separated. Before it is discharged overboard, the water is checked by a monitoring system type Seres, with a signalling system and a recording, in case the norm is exceeded, of the oil product content in the discharged water. When the norm is exceeded, the water is automatically recycled into the settling tank.

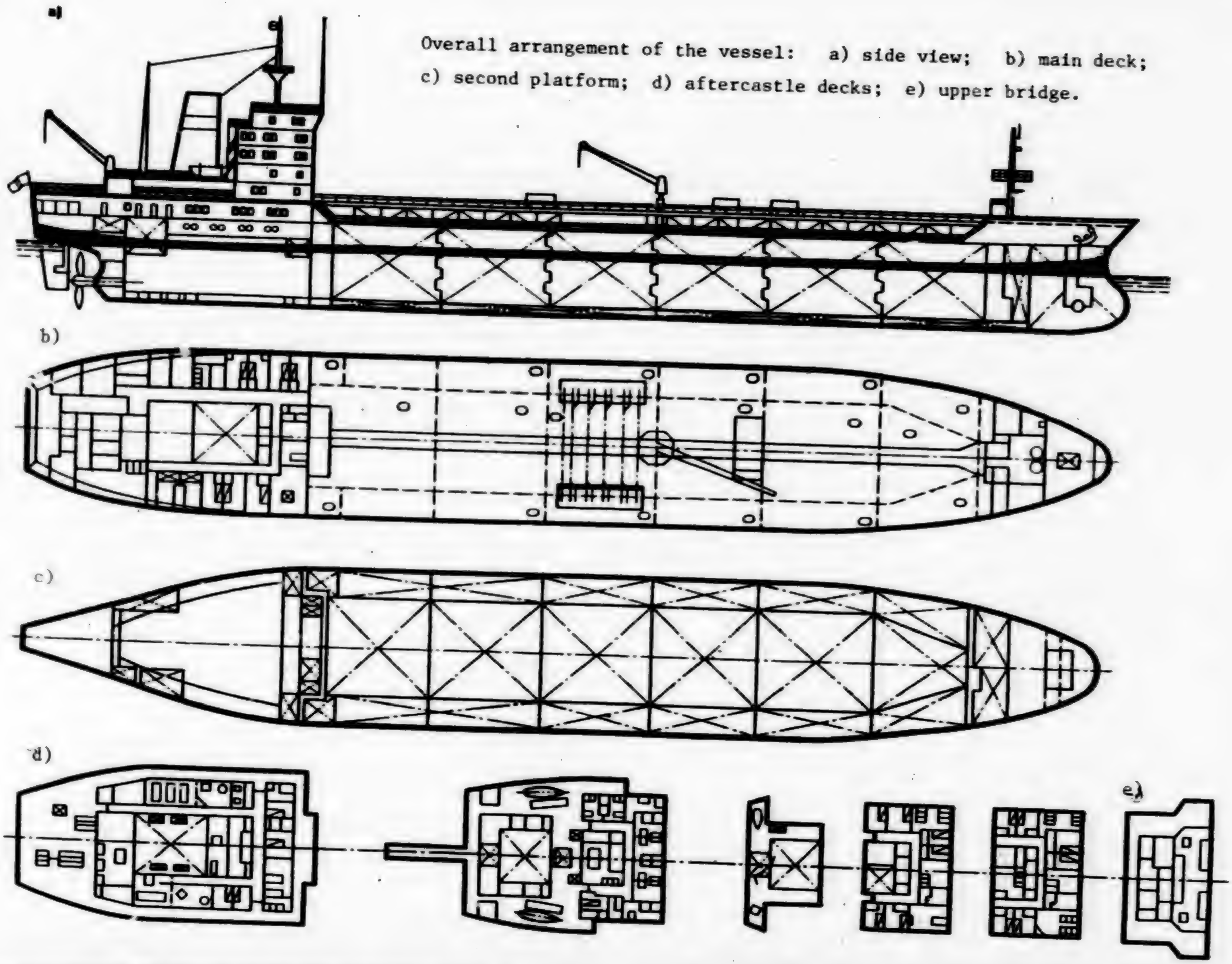
The vessel has bow and stern anchor gear. The bow anchor gear is equipped with remote control (from the wheelhouse) of the brakes of the single-anchor, hydraulic driven windlasses with counters of the eroded chain and automatic control of the speed (light braking of the windlass sprocket).

The four-cylinder electro-hydraulic steering engine with two pump units, produced by the Vulkan firm (SFRY) satisfies all recent norms and regulations.

The life-saving unit consists of two motorized enclosed lifeboats, five inflatable life rafts and the necessary number of life preservers.

The vessel's main engine is a leading model of a low-revolution engine, MAN type K65Z 52/105CL, manufactured by the diesel plant of the Split Association,

Overall arrangement of the vessel: a) side view; b) main deck; c) second platform; d) aftercastle decks; e) upper bridge.



with a maximum continuous power of 5310 kilowatts (7200 h.p.) at a rotational frequency of 165 rpm, operating on fuel with a viscosity up to 3500 from Redvud 1 at 100°F.

Taken into consideration in manufacture of the engine were recommendations of the firm, MAN--Burmeister and Wain, regarding its modernization, which led to a reduction in diesel fuel consumption from 198 to 189 g/kw-h.

Basic Specifications of the Vessel

Length:	
Overall	151.3 M
Between perpendiculars	142.6 M
Breadth	22.4 M
Height of the side	12.1 M
Draft:	
Specificational	8.5 M
Maximum	9.0 M
Deadweight:	
With draft of 8.5 M	15,000 T
" " 9.0 M	16,400 T
Capacity of cargo tanks	20,500 M^3
Speed	14.9 knots

An adjustable pitch propeller from the Lieps firm (Holland) is installed on the vessel, and a deadwood unit of the Vaukesha-Lieps type.

To provide the vessel with compressed air, there have been installed two main electric-drive double-stage compressors of the Khatlapa type (produced by Split) with a feed of 146 cubic meters per hour at a pressure of 30 bars and two Khatlapa compressors (FRG): pumping with a feed of 31 cubic meters per hour, and for service needs, with a feed of 172 cubic meters per hour at a pressure of 7 bars.

A waste heat boiler provides 1300 kilograms of steam an hour with 90-percent maximum continuous power of the main engine. There are also two auxiliary boilers of the vertical type with a productivity of 7 tons per hour each, with automated burners, from the Saake firm (FRG).

The vessel has an incinerator, a unit to process waste water and fecal waters and a separator for the bilge waters.

The vessel's power plant consists of two brushless diesel-generators with a power of 700 kv·A at a rotation frequency of 750 rpm and one brushless shaft generator with a power of 900 kv·A at 1500 rpm. The shaft generator is driven into rotation through a two-stage reducer produced by the Rank firm and a multi-disk clutch. The diesel generators are adapted for operation using heavy fuel with a viscosity up to 3500 from Redvud 1 at 100°F, for which there is a

system to prepare the fuel produced by the IMO Marine firm. One diesel generator provides the vessel's running operations.

An emergency diesel-generator made by the Famos firm, produced in the SFRYu (under license from the Mercedes firm), with 100 kw·A and automatic start-up when the current is cut off is installed on the vessel.

The extent of automation, remote control and monitoring was fulfilled to the symbol A1 of the USSR Register of Shipping class with 24-hour non-watch service of the engine room under normal operating conditions when underway. The main engine operation is monitored and controlled from the TsPU [central control panel] equipped with an automatic air conditioning system. There is remote control from the flying bridge.

The remote control of the GD-VRSh [generator engine-regulated pitch propeller] is a pneumatic type of the MAN-Burmeister and Wain firm. The DAU [remote automated control] system is an electronic type using FAMP-S microprocessors from the ACEA firm (Sweden).

There are two control programs: combinatory (simultaneous change of the propeller pitch and rotational frequency of the main engine crankshaft) and with constant rotational frequency. At the TsPU the propeller pitch control handle is independent from the rotational frequency control handle. The control system has a blocking system, excluding any change in the rotational frequency of the main engine crankshaft, if the shaft generator operates using a network. The pitch and rotational frequency control handles are combined in the wheelhouse. There is analogous control from the bridge wings. When control is transferred from the wheelhouse to the wings, no switching is required. A reversograph is installed in the wheelhouse.

Automated remote control of the diesel-generators, type GENA-S is also produced by the ACEA firm. The automatic system of the electric power station ensures the start-up of the reserve diesel-generator when there is a current cut-off of the main switchboard bars, low lubricant pressure and exceeding of the permissible rotational frequency. There is automatic start-up of the reserve mechanisms when there is loss of pressure, as well as when reestablishing pressure after current cut-off. In the latter case the mechanisms operating earlier are started up.

The alarm-warning system type ALSI-8 installed on the vessel was manufactured in Yugoslavia at the Rade Konchar enterprise under license from the ACEA firm. There is a device to print the rundown of the parameters which fix the date, time and point number. The alarm system has a block which excludes false signals when the mechanisms start and stop. The signals are grouped into critical and non-critical ones. During the non-watch service of the engine room, the signals are transferred to the wheelhouse, the mechanics' cabins, crew quarters and messroom. Only acknowledgement of the signal in the engine room finally cuts off the signals at the generalized signal boards in the above-mentioned facilities. There is a switch on the TsPU to select the watch mechanic.

To improve the maneuvering qualities of the vessel, there is a bow steering device with VRSh from the Lieps firm, driven by a 367 kw power electric motor forming a resistance up to 5 ton-forces. The steering devices are controlled from the wheelhouse and from both the bridge wings.

The cabins are estimated for 40 persons, including four trainees and the pilot. The entire crew is allocated to single-berth cabins with individual lavatories and showers, and the trainees--to double-berth cabins. All the cabins are air-conditioned. The vessel has a swimming pool, gymnasium, sauna, hobby facilities and a darkroom.

The modern means of electrical navigation and communications, including an accessory navigation system, ensure reliable communications and maritime navigation safety.

12151
CSO: 1829/196

PORTS AND TRANSSHIPMENT CENTERS

MECHANIZATION HELPING ODESSA PORT TO PROCESS MORE CARGO

Moscow MORSKOY FLOT in Russian No 4, Apr 85 pp 12-14

[Article by V. Ivanov, chief engineer of the Odessa port: "Technical Progress and Labor Records"]

[Text] In the 11th Five-Year Plan the Odessa dock workers have processed tens of millions of tons of foodstuffs, amounting to more than 80 percent of the entire freight processing volume. We have a specific program aimed at increasing port throughput, raising the intensity of freight operations, and systematically lowering their labor-intensiveness.

Equipping the port with a floating grain reloader; automatic loaders, which have grown in number from 158 to 287; "Kal'mar" front-end container loaders; tractors; single-scoop loaders; and other equipment has played a large role in lightening the work of the dockers. It is necessary to single out here the telescopic "J-C-B" loaders with a high freight lift which are used effectively for transferring individually-packaged freight into holds and warehouses.

The port's material and technical base, although it does not yet fully answer the requirements of the port, is already creating the prerequisites for a further increase in freight processing intensity and a growth in berthing line productivity. Our subunits are also working to improve the use of the machinery which has been obtained to process heavy and labor-intensive freight. The supply products list includes different crane fork grips, both single and paired; packaging straps; crane clamps for rolled paper, cable rolls, barrels, bales; suspension arms for handling cargo in packages; container crane clamps with a hoisting capacity of 20 and 30 tons. Special platform ramps have been installed with the introduction of a new totally-mechanized system for loading citrus fruits and meat into refrigerator cars. The experimental shop of the port's technological division has made a number of gripping devices for mechanizing labor-intensive operations.

Thanks to all of these measures, from 1980 to the present the docker-machine operator crews have set many labor records for processing ships with labor-intensive export-import cargo.

The records were made in those areas where the work was done in accordance with progressive technology and with the use of modern machinery, and where labor organization and efficiency was at a high level. One should especially point out here the records established by the dockers for processing ships with foodstuffs--meat carcasses, boxes of cheese, butter in cases, barrels of fat, dry milk in sacks, and dead poultry in boxes on single pallets. The docker crews also reached record productivity on such labor-intensive cargo as aluminum utensils, glass, caustic soda and soda ash, paper, asbestos, cellulose, footwear, tobacco, and equipment.

The task has been set in the food program for maritime transportation to build specialized complexes for transshipping such cargo in the Baltic, Black Sea, and Far East basin ports. To solve this problem, the Odessa dock workers have constructed several new food cargo transshipment complexes and are constantly working to further improve and increase the capacity of existing complexes. Just the modernization of specialized berths number 7 and 13 and of the elevator complex has permitted a doubling of ship processing intensity and the provision for the daily loading of up to 600 railroad cars or the loading, on the average, of 36,000 tons of grain.

A specialized complex to process loose unrefined sugar is operating successfully at the port. This special-purpose structure has a planned capacity of one million tons a year. An organizational and structural reorganization recently took place at the port which resulted in the establishment, without increasing the number of administrative personnel, of an independent third freight area of the port where the processing of only loose cargo has been concentrated. The indicated complex has also formed part of this area.

The number of cranes at the complex has now increased to six and the capacity of the grippers being used has reached 7-9 cubic meters. Portal storage bunkers, 63 cubic meters in capacity, which are more modern and more convenient for working with a gripper, have been installed here. Thanks to the storage of freight in bunkers, sugar unloading goes on uninterruptedly even during short-term conveyor line shutdowns and their equipment is maintained during the periods when the holds are cleaned. Additionally, because of a change in the angle of inclination of the rollers (which has permitted a deepening of the chute), the productivity of all conveyors has increased.

Modernized PSG-100M loaders with remote control and T-515 scoop loaders remodeled by efficiency experts have been introduced on 'tweendeck ships when clearing cargo.

With the constantly growing flow of cargo to Vietnam, a specialized transshipment complex for processing freight to this destination was organized in the port. This complex has four crews of 42 people each. Outstanding dockers have headed the crews: V. Zimoglyad, A. Gubanov, V. Strel'tsov, V. Kharchenko. Each enlarged crew works a shift at full strength and processes the entire ship at the complex. Thus, each ship is provided with 12 around-the-clock mechanized lines at this complex. Sanitation and service as well as auxiliary areas have been placed in a block next to the warehouse so the dockers do not have to lose time in moving from the public services to the work areas.

The net intensity of processing the fleet was little more than 600 tons a day before the establishment of the complex. A year later this indicator had doubled. Now it reaches 1800-2000 tons a day for some ships. Soon the complex as a whole must attain this figure.

After renovating and modernizing berth number 2 at the Karantinnyy pier and broadening the warehouse area with space reclaimed near the sea (warehouse space will increase to 75,000 square meters when this work is completed), the reception of ships with internationally-standardized containers was organized. Unloading is being done by portal cranes equipped with ZKS-1S container grapples, transportation by roller trailers and "Dubrava" trolleys, and storage is in two layers by "Kal'mar" front-end loaders.

The Odessa port is helping the international shipping enterprise Interlikhter by providing maintenance and agency servicing of lighter carriers and lighters: the port is receiving and processing lighters (unloading, loading, guarding, and maintenance during the settling period).

To further speed up fleet and railroad car processing, it is necessary to continue improving the technology and mechanization of loading and unloading operations, the introduction of new equipment, and the modernization of equipment in close cooperation with scientific research and planning and design organizations.

This will ensure in the future an increase of all port work economic indicators. Scientific and technical progress will create the conditions for new labor records.

8524
CSO: 1829/225

DESIGN OF PNEUMATIC GRAIN LOADERS FOR RIVER PORTS

Moscow RECHNOY TRANSPORT in Russian No 3, Mar 85 pp 14-15

[Article by V. Tokmakov, chief of the TsPKB Minrechflota [Ministry of the River Fleet Central Planning and Design Bureau]: "Machines for the Transshipment of Grain"]

[Text] Since the 1950's, the Central Planning and Design Bureau of the Ministry of the River Fleet has been designing pneumatic grain loading machines. Two of the first floating loaders, the EMM-1 and the EMM-3, have been successfully operated for almost 30 years in the port of Ufa of the Belaya River Shipping Company. After repeated modernization, their productivity in alongside transshipment amounted to 120-130 tons per hour.

The next stage was the development of on-shore pneumatic loaders for transshipping grain from ships into rail cars or storages.

In the navigation season of 1960, the stationary on-shore pneunmatic transshipper of project 1293 designed by the TsPKB was put into service in the port of Liski (now Georgiu-Dezh). Its productivity of 75 tons per hour satisfied the requirements of the VDRP [Volga-Don River Shipping Company] in the processing of small-tonnage ships.

In 1980 at the testing and experimental plant of the TsPKB, a more productive grain loader (of project 3642A) was put into operation. It consisted of a stationary pneumatic installation with a productivity of 120 t/hr.

More versatile is the project 3931 pneumatic transshipper for the port of Kalach. It is now being built according to a design of the TsPKB at its testing and experimental plant. It is a gantry installation with a track width of 10.5 meters which allows its use in any ports with the same track gauge. A commercial productivity of 120 t/hr with a maximum suction height of 18 meters is achieved with six vacuum pumps. Grain intake from a ship is accomplished with four telescopic grain pipes. For serving the maximum area of the holds during the processing of a ship, the transshipper's mechanism for movement is used. Loading of railcars is done by means of an eight-ton capacity intermediate bunker through hatches in the tops of the rail cars on either of two railways under the gantry.

All the transshippers designated for the ports of the Volga-Don River Shipping Company were developed by the TsPKB with creative collaboration. Over many years, business relations between the TsPKB and the VDRP have been established.

At the end of 1982, the TsPKB received an assignment to urgently develop loading devices for the transshipment of grain from the river to railway transport in ports of the Kama, Volga, and Don rivers. All of the work (design, construction, installation and activation) was to be completed in a year.

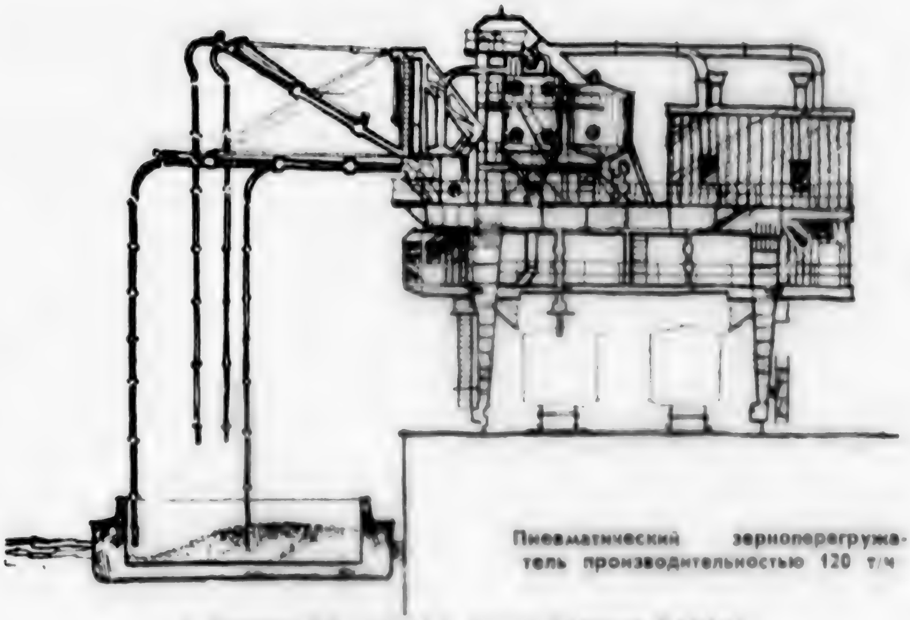
For the ports of the Kama and Volga project 4171 was developed - a self-propelled gantry pneumatic transshipper with two grain intake pipes having a mechanism for raising, lowering and rotating in the horizontal plane. A telescopic device with a separate drive permits lengthening the vertical section of a grain intake pipe. Suction of the grain is done to a height of 29 meters. The loader has four grain bunkers each with a 17 ton capacity. Two rail cars under the gantry are loaded simultaneously through discharge pipes.

Project 4194 was made for the port of Kalach using two available crane gantries. The grain loader is a pneumatic installation, with a suction height of up to 29 meters,which is mounted on a "Ganz" gantry crane. As in project 4171, a "(Neuer)" serially produced grain unloader with two blowers operating in series was used as the suction unit. The grain is fed into two bunkers each of 10 ton capacity. Rail cars are loaded under the gantry by four discharge pipes through hatches in the tops of of the cars.

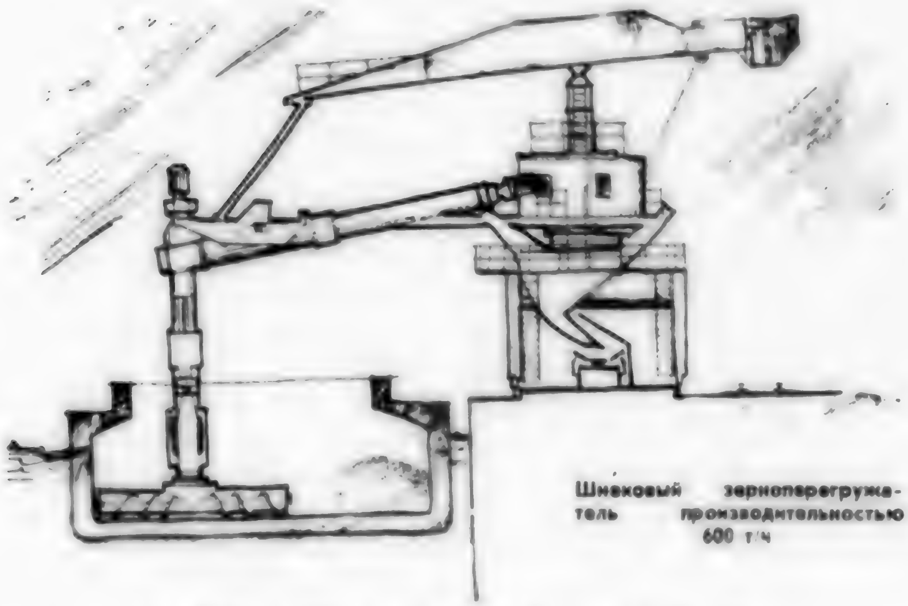
The shutoff process for the discharge of grain provided for by these pneumatic machines excludes contamination and scattering.

Both types of machines of projects 4171 and 4194 were built rapidly at the ports of Kazan, Saratov, Perm, and Kalach with the enlistment of the plants of the corresponding shipping companies. The manufacture of the grain transshippers by the ports was organized on a high technical level. After receiving the working drawings these loading machines were built in the course of a year. Specialists of the TsPKB constantly carried out supervision and concurrently solved design problems proceeding from the technical capabilities of the ports. This business collaboration brought about the fact that already in the 1984 navigation season, three of the project 4171 pneumatic grain loading machines in the ports of Kazan, Saratov and Perm, and two of the project 4194 machines in the port of Kalach were put into operation.

The development of the project 4171 grain loader having a productivity of up to 180 t/hr and the project 4194 unit with up to 90 t/hr can serve as an example of collaborative creative work of designers and industrial workers. From the moment of receipt from the ministry of the assignment for the development of these machines to their being put into operation, one and a half years passed; whereas, formerly, this has taken six or seven years.



A pneumatic grain transhipper having
a productivity of 120 tons per hour.



An auger-type grain transshipper having
a productivity of 600 tons per hour.

These installations, however, have deficiencies (large electrical energy consumption, limited productivity, and difficulty of servicing). In this connection, the designers have developed a new transshipper (project 4100) having an auger unit which will be installed at the Moscow Yuzhnyy Port.

This gantry machine moves along a 6-meter gauge railway. A rotating part with the machinery compartment and a boom which carries the vertical auger lift with its the horizontal raking-up auger is mounted on the gantry. The height of lifting the grain is 9 meters. The horizontal 7.5-meter-long raking-up auger can be rotated through an angle of 200 degrees. The boom for the vertical auger lift is 14.25 meters long. The grain from the vertical auger lift is transferred to a horizontal auger and then, through a system of troughs, into a bunker and onto a shore transporter for loading into rail cars.

The commercial productivity of the machine is 600 tons per hour.

Because of the lack of pneumatic grain loaders in river ports, grain is being transshipped by cranes using special clamshell buckets as in the Moscow Yuzhnyy Port. Two 10-ton capacity "Al'batros" gantry cranes transfer up to 4000 tons of grain a day from ships to rail cars by the direct method. The rail cars are loaded through a self-propelled bunker designed by the TsPKB. Two railcars are loaded simultaneously. Special raking-up clamshell buckets of the project 3829 closed type having the span of the jaws increased to 6.24 meters in the open position were developed for these cranes. This makes easier the work of cleaning up after unloading.

Despite the high productivity of transshipping grain by cranes, however,this method has significant disadvantages. In the process of unloading, the grain is subjected to atmospheric precipitation and wind contamination. The Moscow Yuzhnyy Port, therefore, plans to replace the cranes with the auger-type grain loaders of project 4100.

The cleaning of residual grain from the holds of ships is accomplished by various means depending on the means of mechanization provided in ports. Cleaning machines of various designs are used including the Case and Clark imported machines. A rather high percentage of the work, however, is done by hand. In this connection, the inflatable envelope device should be recalled which practically solves the problem of cleanup operations after unloading grain with a pneumatic grain transshipper. (RECHNOY TRANSPORT No. 12, 1980).

That device was manufactured in 1979 according to project 3718 developed by the TsPKB together with LIVT [Leningrad Institute of Water Transport] and installed on the 300-ton cargo capacity motorship GT-364 of the Volga-Don Shipping Company. In proportion to the unloading of the grain from a hold, air is blown into the envelope device forming peculiarly shaped bubbles as a result of which the grain is moved to the middle of the hold. At the conclusion of unloading , the air is eliminated from the envelopes and they return to their original position. Residues of grain subjected to cleanup with such a method of unloading are minimal and are found only around the centerline plane in a band about 1.5 meters wide. The time for unloading a

ship is reduced by 10-12 percent because of keeping the pneumatic transshipper at full load constantly. The labor consumption for cleaning up is reduced fourfold. Such a device, in our view, is most suitable for the small-tonnage fleet having wooden flooring on the deck plating, which excludes the use of any cleaning equipment.

The method of unloading grain with a pneumatic grain transshipper from a ship having the envelope device was demonstrated at the VDNKh [Exhibtion of National Economic Achievements] in 1982. For the development and introduction of the system of transshipping grain by these methods, the TsPKB was awarded a diploma of the second degree by the VDNKh. A final decision, however, on the use of rubberized fabric envelope devices on ships for the cleaning operations has not been adopted by the appropriate administrations of the Ministry of the River Fleet up to now.

9136
CSO: 1829/222

MISCELLANEOUS

UDC 39.17

STATUS, FUTURE DEVELOPMENT OF TRANSPORT COMMO SYSTEMS IN USSR

Moscow SOSTOYANIYE I PERSPEKTIVA RAZVITIYA TRANSPORTNYKH SISTEM SVYAZI(NOVOYE V ZHIZNI, NAUKE, TEKHNIKE: SERIYA "RADIOELEKTRONIKA I SVYAZ'") in Russian No 10, Oct 84 (signed to press 26 Sep 84) pp 1-59, 63-64

[Annotation, articles by K. K. Venskauskas, "Radio Communications in the Marine Service", by A. A. Kuznetsov and O. S. Nabatov, "Status, Future Development of Electrical Communications in Aviation"; by V. V. Grigorin-Ryabov; "RR Transport Communications;" and the bibliographies of brochure "Status, Future Development of Transport Communications Systems in the USSR." Izdatel'stvo "Znaniye", 41,230 copies, 64 pages]

[Text] Annotation

This brochure contains a review of the modern state and future developments of communications systems in marine, aviation and RR transport. Special features of transport communications are analyzed for each type. Written for lecturers and all those interested in new communications systems.

RADIO COMMUNICATIONS IN THE MARINE SERVICE

[By Kostas Kostovich Venskauskas, candidate of technical sciences, senior staff worker. Has 25 patents. Awarded two VDNKh medals. Prize winner of Scientific Technical Creative Youth in 1979. Scientific instructor in the "EMS in Radio-receiver Devices" School at the USSR VDNKh." Ten papers by the author have been published abroad.]

Introduction

A. S. Popov began making the first tests in communications by means of electromagnetic waves in 1895 and, in the summer of 1897, tested them on the sea. In June 1899 P. N. Rybkin, A. S. Popov's assistant and D. S. Troitskiy, chief of the telegraphy crew, discovered the possibility of receiving telegraph signals by means of telephone receivers. On the basis of this discovery, A. S. Popov developed the design of the first radio receiver. This method of radio reception is the basis of marine service radio communications (MPS).

The popularity of radio communications increased rapidly because radio telegraphy solved the communications problem on the seas and in rugged terrains. The increase in the number of radio stations required the regulation and standardization of a number of problems on a worldwide scale.

In August 1903, the First International Radio-Telegraphy Conference was held in Berlin in which most of the European countries (including Russia) and the United States participated.

In 1906 the Second International Radio-Telegraphy Conference was held in Berlin at which a summary of rules for radio traffic called Operating Rules was adopted, as was an agreement on setting up radio traffic and a single international distress signal (SOS).

The Third International Radio-Telegraphy Conference was held in 1912 in London. Its most important decision was that all shipowners equip their ships with standby (emergency) radio transmitters with independent power supplies that would guarantee a radio communications distance of 80 knots (a knot is equal to 1852 meters) for large ships and not less than 50 knots for smaller ships with limited radio watch time. Special signal services for precise times, meteorological data messages and radio beacons were also established at the conference.

In 1927, in Washington, the Operating Instructions were supplemented by the still existing alarm,urgency and safety signals, as well as by recommendations for using radiotelephone communications which had just begun. In order to coordinate the use of radio communications for navigational safety, periods of silence were established (from 15 to 18 minutes and from 45 to 48 minutes of each hour) as was a single call and emergency frequency of 500 kHz (600-meter wavelength). These rules are still in use.

The basic achievement in the development of marine service radio communications in the technical respect was the creation at the Madrid conference in 1932 of the International Electrical Communications Union (MSE) which replaced the International Telegraph Union which had existed since 1868 and which was also concerned with decisions made at the Berlin Radio-Telegraphy Conference in 1906 with regard to questions of radio communications. The Madrid conference revised the table for the distribution and usage of frequencies by various services and the table of call signals was revised to allot to the USSR the letter U to the previously allotted letter R.

The next international conference on radio communications was held in Cairo in 1938. Then, in 1947 in Atlantic City (United States) and at one international conference there were developed Instructions for International Conventions for Electrical Communications and Radio Communications. Later, at successive conferences in 1952 in Buenos Aires, in 1959 in Geneva, in 1965 in Montreux (Switzerland) and in 1973 at Torremolinos in the province of Malaga (Spain), reviews and additions were made to the International Electrical Communications Conventions. At the 1965 conference the problems of space communications and the use of space for peaceful purposes were also reviewed.

The 1973 international conference adopted a new electrical communications convention which became effective 1 January 1975.

In 1967 Geneva was the site of a World Administrative Conference of Radio Communications (VAKR) in marine service which introduced a number of changes in the Radio Communications Operating Instructions. The reason for this conference was an acute shortage of telegraph and telephone channels for radio communications in the MPS. The VAKR-67 recommended the utilization of radio beacon indicators for sending SOS.

The second VAKR for marine communications was held in 1974 in Geneva to review the corresponding articles of operating instructions. Its decisions established ways to develop MPS radio communications for the next decade. New, more rigid norms were adopted for the frequency stability on ships and shore MPS radio transmitters, operating in the telephone and telegraph modes, as were more rigid norms for extra-cavitous radiation.

The VAKR introduced changes in the order of using the meter-wave range in the marine service. The use of this range was permissible not only for radio telephone communications, but also for facsimile transmissions, printing and data transmission. A new service was organized to regulate ships' movements and corresponding radio communications channels were assigned for these services. A procedure was also adopted to use radio channels in the meter-wave range for communications between ships and airplanes. The VAKR-74 attached great importance to the 156.80 megaHz frequency in raising the safety of navigation and adopted a decision to assign to this frequency the status of an international frequency intended to transmit SOS, safety and calling signals.

A number of decisions was adopted concerning marine satellite communications systems being introduced and radio assignments. Operating instructions regulations in radio communications were issued so that they could be applied to new satellite services.

On 1 February 1982 an International Satellite Communications System (SSS) INMARSAT was officially introduced, designed on the basis of the SSSMARISAT (United States). It represents a system of earth satellites serving as radio relay transmitters of messages between ships equipped with special apparatus and shore radio stations connected with shore subscribers by international and national communications.

When building ships, navigational safety is the primary concern of shipbuilders. However, taking into account the fact that accidents happen not only to poorly built ships, but also to the most modern ones, the question of providing radio equipment for ships also concerns the organs that monitor shipbuilding.

Further we will also name several other organizational measures concerning radio communications on the seas. The "Titanic" catastrophe in April of 1912 was the reason for the International Conference on Safety in Navigation. At the conference held in April 1914 in London, the first convention for saving

human life at sea was signed. Radio communications were assigned a very important place at the convention, and a decision was adopted to equip with radio stations all ships that have unlimited navigational regions and that have over 50 people on board.

A consolidated Committee of Intergovernment Consultative Organizations (IMO) and the International Hydrographic Conference were created in 1973 on the dissemination of navigational warnings to navigators over the radio.

A VAKR was held in February-March 1983 at which on the presentation of IMO, requirements were determined and specific frequencies assigned in all frequency bands for a global navigation communications system for SOS to secure navigation safety (GMSSBB) which would be designed on the basis of the latest achievements in science and technology. It is planned to begin introducing the GMSSBB in 1990.

To insure navigational safety and guard human life at sea, the GMSSBB proposes the use of satellite radio communications along with traditional means of radio communications. At present, work is being done in parallel in the USSR, Canada and France, according to an intergovernmental agreement on investigating and utilizing space for peaceful purposes. The USSR will work on the KOSPAS (Space System for Searching for Ships and Aircraft in Distress) project, while the United States, Canada and France will work on the SARSAT (Search and Rescue Satellite Aided Tracking) project. After completing the joint experiment, the KOSPAS and SARSAT will prepare joint recommendations on creating an operational system for searching and rescuing distressed ships and aircraft within the GMSSBB framework.

STRUCTURE AND ORGANIZATION OF RADIO COMMUNICATIONS IN THE MARINE NAVIGATION SERVICE (MPS)

Purpose of radio communications in the MPS. MPS radio communications in the USSR is one of the most important means of guiding the work of marine transport and organizing fleet traffic.

The basic purpose of MPS radio communications is to insure navigation safety and protect human life at sea, efficient dispatcher guidance of fleet operation, control of the fleet, steamship companies, shore enterprises and other organizations related to the operation of marine transport, as well as the servicing of ships' crews and passengers with radio communications and satisfying the cultural requirements of seamen [1-6].*

Radio communications facilities are used in the MPS to communicate with a moving object, to transmit (receive) telephone, telegraph and facsimile messages to addressees, locate moving objects, as well as on shore, for communications between moving objects (ship to ship, ship to aircraft, ship to helicopter etc.) and to communicate between ports in the same basin having small volume of exchange, to build radio-information, radio-reporting, radio-observation networks, for radio communications with shore MPS in case there

*Sources cited at the end of the book.

are no wire, cable or radio relay facilities between them, as well as for communications between USSR MPS on shore radio stations and shore radio stations in foreign states in case of an exchange of distress signals from ships or when it is necessary to provide mutual help.

Radio communications has, as a rule, four basic functions in the MPS: it is the basic means for electrical communications with moving objects, eases overloaded wire (cable) and radio relay communications channels, saves wire and radio relay communications channels and is a directional means for communications with an unlimited number of terminal (receiving) points.

Organization of the MPS radio communications network. The totality of all moving objects and the geographically dispersed MPS communications points make up the MPS communications network [3, 4].

Speed, accuracy and efficiency of transmitting messages are the most important demands made of the MPS radio communications network. These demands are satisfied when the communications network as a whole, its individual sections and the radio and wire communications channels have a transit capacity that provides a short waiting time for transmitting a message and when all the received data is processed in the shortest time.

The MPS radio communications network consists of several thousands of mobile ship and port radio stations, radio centers of steamship lines, industrial associations and other subdivisions. All of them differ by the scale of production activity, the number of workers, the amount of equipment, the skill of the personnel and the standard of organization.

The MPS communications network is built on the production-territorial principle. The essence of this principle is in the creation of communications centers at all MPS production subdivisions. An example of such communications centers may be radio stations in ports, radio stations at the Minrybkhoz [Ministry of the Fish Industry] floating bases, communications sections in ports and radio centers of steamship lines. A special subdivision, the communications and electrical radio navigation service, guides the work of shore communications centers within the activity area of the marine steamship lines of the Minmorflot [Ministry of Maritime Fleet], the river steamship lines of Minrechflot [Ministry of the River Fleet] or the production association of Minrybkhoz. The organizational-technical facilities of radio communications of long-range vessels of a shipping company are managed by the communications and electrical radio navigation service independently of the territorial location of the ship [3, 4].

The "Morsvyaz'sputnik" All-Union Association controls the operations of the whole network (wire and radio) and guides the activity of all communications centers, and is the electrical radio communications navigation service of the Minmorflot.

Radio communications subsystem that provides navigation safety and protection of human life at sea. The decisions of the international conferences on MPS radio communications for navigational safety and protection of human life at sea always pay special attention to the operating mode of ships' radio stations, to the length of their radio watches, to providing observation of special call and distress channels during periods when part of the ships do not have radio watches [4, 6-8].

During rest periods of radio operators, automatic radio receivers and automatic alarms monitor distress signals. They operate when an alarm signal is received and activate an alarm indicator on the navigation bridge and in the cabin of the radio operator.

Radio stations on ships at sea carry listening radio watches according to an international schedule at international frequencies (radio communications channels) to receive calls and to transmit signals of special importance, to insure the reception and transmission of messages and their verification of messages concerning accidents, navigation warnings, meteorological forecasts, medical counsel and other information.

It is interesting that the first SOS signal sounded in 1898 from the ship, the "Matthews," which collided with a floating beacon near Dover. However, it required almost 8 years of negotiations for this signal to become international.

There are special services in the MPS radio communications system for providing navigational safety and preserving human life. These systems are intended to provide navigation with information that facilitates safe navigation, makes it possible for ships to determine their positions and monitor the execution of existing operating instruction by ship operators for radio communications [3, 4, 7]. These services include a meteorological service for transmitting hydrometeorological information; a radio direction-finding station service which determines locations or directions in which the radiating station is located; a radio beacon station service whose radiations are used by ship radio stations to determine their locations; a precise time signal service; a service for monitoring radio radiations that checks the stability of ship radio transmitter frequencies as well as special radio stations for transmission of messages to navigators and radio stations for transmission of medical consultations.

MPS radio communications subsystem for efficient dispatcher control of the fleet and to satisfy the needs of ship crews and passengers. Telephone and telegraph radio communications in the decimeter, meter, decameter and hectometer ranges are used for this purpose [3, 4, 6-8]. Although the organization of communications in this subsystem must span all facilities and kinds of ship radio communications, so far the basic loading in the telegraph mode falls into the decameter wave range while, in the telephone mode -- in the meter and decameter wave range [4, 9].

The improvement in radio communications equipment for efficient dispatcher control of the fleet, along with the introduction of satellite communications

[4, 9-11] calls for a more efficient utilization of radio communications in the decameter wave range by introducing new, more noise-resistant radiations (frequency telegraphy, narrow-band relative phase telegraphy etc.) and algorithms for processing received signals (adaptive interference compensation, noise suppression etc.).

Radio communications in this subsystem can be subdivided into intracoastal radio communications when ships are at anchor in ports or are on voyages.

Intracoastal radio communications are used to interchange information between ships and shore facilities within marine ports, in open or loop sea voyages, as well as in approaches to ports [4]. Intracoastal radio communications are implemented primarily in the meter wave range in the telephone mode and provide for the exchange of information at distances of up to 40 to 60 kilometers. At great distances, coastal radio communications are implemented in the hectometer wave range in the telephone mode (1605-3800 kHz frequency band) or in the telegraph mode (405-535 kHz frequency band)[4]. While ships are anchored in port, radio communications are implemented only if there are no telephone communications with shore facilities and services. In this case, radiotelephone communications are used in the meter wave range. When a ship is in a foreign port, radiograms are received as well, but without confirmation.

After completing long trips, ships maintain constant radio communications with their steamship lines through zonal radio centers and in case of an acute necessity, also through radio centers in other countries.

The description of foreign radio centers and radio stations that may be used for communications can be found in the international manual "List of Shore Stations" [12]. This manual cites data on shore radio stations in the countries in the world with the necessary information for establishing radio communications with any shore radio station on the list.

A message switching center (TsKS) [13] was placed in operation at the Central Communications Center of the Minmorflot in 1980 for automatic fleet control. The TsKS is connected with communications lines to radio centers of all Minmorflot steamship lines. The installation of the TsKS is the first stage in creating an automatic telegraph communications network (ASTS) of the MPS. The TsKS operating experience confirms the correctness and prospects of the basic assumptions of the project in creating the ASTS whose nucleus is high productivity TsKS in a central communications unit (TsUS) and lower productivity TsKS in all radio centers of the steamship lines. An analysis of the operation of the TsKS in the Minmorflot TsUS indicates that placing it in operation increased considerably the efficiency of communications in shore communications centers. The average time for transmitting urgent telegrams is 1 to 2 minutes.

In manual processing this time was larger by tens of minutes. The utilization of rented communications channels (with loading it approaches 100 percent) improved considerably, especially when transmitting from the TsKS. Intraregional telegraph communications improved considerably due to the reduction in telegram transmission time. The basic technological process, the

processing of transit correspondence, was automated and made it possible to eliminate from the technological chain the section for the output-input of transit information and improve the quality and authenticity of the information considerably. Automatic logging of the exchange made it possible to eliminate cumbersome manual work.

The installation of a TsKS at the shore radio center of the steamship line and a "Brig" radio transmitter, a "Tsikloida" radio receiver and a "Sokol-MR" data transmitting apparatus, operating in the call mode of the ship radio station from the shore radio center, as adopted in the "Mariteks" system, will make it possible to organize a message switching mode. Then, when the TsUS is in communication with any ship located at any point in the World Ocean in the decameter wave range, it will be able to transmit data with an error coefficient of not greater than 10^{-4} with a transmission time in the "subscriber-ship" direction as well as in the "ship-subscriber" direction of not over 30 minutes. The probability of obtaining the indicated values of authenticity and efficiency will be no less than 0.9.

Radio Communications Channels and Facilities for Marine Navigation Service

Basic characteristics of radio communications. By a radio communications channel is assumed a radio frequency resource section (RChR) within a certain range. Therefore, the quality and efficiency of radio communications depend on the transmission of radio waves of various ranges, as well as on the efficient organization of the distribution and utilization of the radio channels. To utilize the RChR correctly it is necessary to know the special features of radio wave propagation in various ranges.

Radio wave propagation methods are divided into rectilinear or freely propagated, ground or surface, tropospheric and ionospheric or spatial.

Various ranges of radio waves are used in the MPS from miriametric -- 3 to 30 kHz (for radio position-finding service) to millimetric -- 30 to 300 gigaHz (in the radar service).

The length of the MPS radio communications channels vary depending upon their purpose from several tens of meters (intraship communications) to several thousand kilometers (communications with ships in the decameter wave ranges due to the reflection from the ionosphere and in the decimeter waves when using satellite relaying). Radio communications channels in the decameter wave range are not always stable at long distances. The reasons for this are the insufficient capacities of radio transmitters, poor transmission conditions etc. [14 -18]. In such cases, radio communications are frequently organized through intermediate (transducer) stations for which intermediate ships are frequently used. Information on such combination communications channels can be transmitted by the transit or the relay methods. The Minmorflot, when communicating with ships in the World Ocean where radio wave transmission is poor, usually use the transit method. Two ships in the Atlantic Ocean and two ships in the Indian Ocean are used for this purpose [3, 4].

Depending upon the problems involved, radio transmitters of various powers are used: from several watts to tens of kilowatts. Overloading RChR, assigned to operating the MPS technical facilities, leads to the necessity of a systematic reduction of separation between adjacent frequencies and, as a result, to increased limits on the allowable deviation of frequencies from the nominal ones, a reduction in the nominal average power of spurious radiations, a reduction in the necessary radiation bandwidth, a limitation of the information transmission speed over radio communications channels etc. All this requires the creation of new transmitting, receiving and metering apparatus, based on the latest achievements in engineering indicated, in particular, in various recommendations of the International Consultative Committee on Radio Communications (MKKR).

The USSR MPS uses the following ship equipment widely: modernized radio transmitters of the "Musson," "Brig," "Korvet" and "Bark" types; radio receivers of the "Sibir'" and "Tsikloida" types; radio stations of the "Chayka-SM," "Angara-RB," "Reyd-1" and "Leyer" types; the "Sirena" emergency set and other equipment [4, 19].

Modern radio transmitters and radio receivers operate on classes of single-band radiation opening up new possibilities for MPS radio communications. The introduction of single-band radio communications facilities made it possible to increase the number of radio channels. For example, from two to four radio telephone channels could be organized with the aid of one radio transmitter and one radio receiver.

Noise situation in ship radio channels and provision of electromagnetic compatibility in ship radio communication facilities. Electromagnetic fields, produced by radio transmitters, radar stations and other electronic devices, have different structures and intensities. Noises originating in some ship facility may be propagated not only through direct radiation by the electromagnetic fields, but also over power supply lines and interdevice connections due to noise induction from some electrical circuits to others. The value of the noise field depends on the radiated wavelength and the distance from the source. Practice indicates that if no measures are taken to suppress radio noises originating from ship equipment, they may exceed allowable norms [4, 20] by 10 to 100 times and more. Therefore, to provide long distance radio communications an efficient noise protection system is required. According to the USSR Register [8] regulations, it is required that the noise increment at the radio receiver input due to radio interference generated by ship equipment should not exceed 20 percent, i.e., the sensitivity of the radio receiver should be set pragmatically on ships.

The noise protection system for ship radio receivers specifies the suppression of radio interference voltages at their sources, providing a certain amount of interference protection in the radio receivers themselves by screening noise-carrying and noise-sensitive cables, providing additional filtration of individual cables and taking measures to increase the attenuation of radio interference in the circuits where they are adjacent to cable runs of the ships, taking protective measures in above-deck devices, as well as using adaptive radio noise compensators [4, 2, 1].

To provide electromagnetic compatibility of operation between radio communications facilities and other electronic devices on the ship it is very important to position the receiving and transmitting antennas efficiently. Considerable voltages can be induced in receiving antennas if they are placed in a limited space. For example, induced voltages may reach 300 to 400 volts [4, 21] in the decameter wave range. High induced voltage values may lead to radio receiver blackout and even make it inoperable. Special protection is specified against induced voltages in the "Sibir'," "Tsikloida" and "Shtorm" radio receivers to provide for the safety of the input circuits [4, 19].

Promising Navigation Radio Communications Systems. In the last 10 to 15 years in creating MPS radio communications systems, special attention was given to their automation using remote control radio facilities. The use of remote control made it possible to develop automatic systems which led to an increase in noise resistance and the efficiency of radio communications in navigation service.

The first automatic radio receivers and transmitters appeared at the start of the sixties and although only several remote control operations were incorporated, it became possible to simplify operation and reduce service personnel while, in some ship radio stations, the job of radio operator was abolished.

One of the first automatic MPS radio communications systems was the "Mariteks" (Marine telex) system, introduced by the Swedish Communications Administration into ships and the shore radio center at Goteborg using data transmission apparatus (APD) that meets the requirements of the 476-2 MKKR recommendation. At present this radio communications system is used widely in the whole world including the USSR MPS system [4, 14].

The considerably higher degree of automation along with an improvement in the quality of radio communications made it possible to develop adaptive marine communications systems as follows: CHEC, CURTS and RACE [4, 14].

The creation of a regional automatic international "Navteks" system to transmit navigational and meteorological data in the area of the Baltic, North and Norwegian seas made it possible to provide round-the-clock automatic reception of navigational and meteorological data on ships equipped with corresponding radio communications facilities. At present, the "Navteks" system is being introduced in the Black Sea, Aegean and Mediterranean seas area.

We will consider in greater detail the design principle and basic characteristics of the MPS "Mariteks, CHEC and the "Navteks" automatic radio communications systems.

The "Mariteks" automatic system is designed to print communications between ships and the "Teleks" network through a shore radio center. The authenticity of data transmission over the radio channels in the decameter wave range between the ship and the shore radio center is increased by using a type STB-75 APD whose characteristics meet the requirements of 476-2 MKKR. The radio channel on the ship as well as at the shore radio center is formed by automatic radio transmitters and radio receivers.

The MPS shore radio center at Goteborg (Sweden) operates such apparatus successfully. The APD, telegraph apparatus and control panels are installed at the receiving radio center. These devices are combined in a common panel in which are located two apparatus which operate on the telex line.

In the initial condition radio transmitters and receivers at the shore radio center are connected to nondirectional antennas while the radio transmitters are radiating at all times a pseudophasing signal into the radio channel which indicates that the radio communications channel is free. The ship radio receiver scans six working frequencies on which the shore radio center transmits.

When calling from the ship radio station the operator, after preparing the punched tape and selecting a free channel by a pseudophasing signal, pushes the starting button of a selective call and after phasing the ship and shore APD and an exchange of interrogation-response signals with the shore radio center, transmits the information. In case the APD is not phased in 20 seconds, the ship set returns to the initial condition and the process of establishing communications must be repeated. When a ship radio station is called by a shore radio station, the ship radio receiver, after receiving the selecting call signal, stops scanning. The radio transmitter is returned to the paired frequency and transmits, acknowledging signals in response to the accepted call. After APD phasing and an exchange of inquiry-response signals reception of data begins from the shore radio center and is printed by the ship telegraph apparatus. Simultaneously a light indicator appears on the control panel and if necessary, an audio signal is given to the operator of readiness for the call. If the presence of an operator is not required, the ship apparatus, after signals of the completion of the communications sequence is received, are returned automatically to the initial condition. When there is information on punched tape this information is removed and confirmation of its reception is sent to the shore radio center.

The CHEC (Channel Evaluation and Automated Call System) is used for calling and evaluating the quality of the radio communications system. Initially it was designed to provide communications between marine aviation and radio centers, but later an application was found in the MPS radio communications system.

The principle of the CHEC operation is that in this system the ship radio station scans all radio communications channels in the decameter wave range, in which the call is expected by the ship radio station and the optimal radio channels are determined from the viewpoint of the signal to noise ratio (OSP), as well as from the radio wave propagation viewpoint.

The selection of an optimal radio channel is determined not only on determining the level of the incoming signal and of the OSP at the ship radio station, but also on the basis of determining the noise level in the paired received frequency at the shore radio center. The quality of the radio channel at the ship radio station is determined by receiving probing signals and determining the OSP at these frequencies.

The radio receiver at the shore radio center also scans the paired receiving radio channels and measures the level of radio noise in each channel. Information on the noise level at the receiving frequencies of the shore radio center is coded and transmitted along with the probing signals to the paired transmitting radio channels to all ship radio stations.

The synchronous sequence for synchronizing the devices for processing signals and other systems are also transmitted together with the probing signals and the information on the noise level at the ship radio station. In case a call is made by the shore radio center after the transmission of of the probing and other signals, group calls are transmitted.

The most important criterion in determining the optimal radio channel in the CHEC system is the evaluation of the noise level in the zone of the shore radio center This is due to the fact that the power of ship radio stations is limited and is usually considerably less than the power of the shore radio centers.

When there are long interruptions in communications due to the deterioration in the transmission of radio signals, or when synchronization is disrupted for other reasons, the receiving apparatus of the CHEC systems begins to scan all frequencies assigned to the given ship automatically. However, in this case the scanning period will be different; the signals will be studied at each frequency during the time the radio transmitter of the shore radio center implements a full cycle for probing all frequencies. As soon as the ship radio receiver identifies the probing signal, the ship radio station returns to the usual operating mode.

To increase the reliability of the communications system and reduce the probability of false operations in the CHEC system, voice frequency signals are used to transmit the selection call; these signals are formed in the telephone channel band and are transmitted by the radio transmitter in a single-band mode.

Basically the advantages of the CHEC system are:

1. Improved reliability of radio communications during ionospheric disturbances and rapid changes in the conditions of radio wave propagation. Improved reliability of radio communications achieved by the rapid and efficient selection of working channels (frequencies); forecasting optimal working radio channels in this case is practically impossible, while the utilization of the usual method for "probing" various working frequencies is inefficient due to the rapid change in conditions for radio wave propagation.

2. Reduced time to establish radio communications and for information exchange due to the fact that the CHEC system makes it possible to select instantaneously an optimal working channel at the given moment and establish in several tenths of a second the frequencies of this channel at the radio receiver and radio transmitter and begin to transmit information.

3. Increased efficiency in using assigned frequencies due to the elimination of the "probe" method, the elimination of reinquiries when an unoptimal working radio channel was selected in the "probe" method. When the quality of a radio channel deteriorates during transmission, the CHEC system makes possible a rapid change over to another radio channel of better quality.

4. An indication is provided when, due to propagation conditions or the noise level, radio communications on any channel assigned to this service is impossible. The CHEC system makes it possible to determine these time intervals and eliminate useless attempts to establish communications, thereby obstructing an already overloaded decameter wave range.

The automatic "Navteks" system for transmitting navigation and meteorological information is designed to transmit navigation and storm and ice warnings, search and rescue information, weather forecasts, pilot messages, as well as messages concerning changes in navigations systems and other messages concerning safety.

On the basis of a decision by the Radio Communications committee of the International Marine Organization (IMO) on the possibility of using printing to transmit navigational and meteorological information in the hectometer wave range (300 to 3000 kHz), the "Navteks" system came into use in 1981 in the Baltic Sea area to transmit messages at a frequency of 518 kHz. The information was received by all ships, equipped with the proper apparatus, at sea and when anchored in ports.

To span the Baltic Sea regions three shore radio stations entered the "Navteks" system in 1981. They were two Swedish: the "Hernosand radio" and the "Hislohammer radio" and one Soviet station, the "Tallin radio." These stations operated on a rigid schedule at 4 hour intervals. However, very important messages concerning navigation safety were transmitted to the ships immediately. All active navigation warnings are repeated during the transmission period according to schedule until they are changed with those newly received at the beginning and then the old ones repeated.

The responsibility zones of the coastal states for transmitting navigational warnings in the "Navteks" system were adopted in the Regional System to Transmit Coastal Warnings in the Baltic Sea.

Navigation and meteorological information is transmitted only in English. The use of a native language is not recommended because it would more than double the time and might interfere with urgent messages.

Receivers used on the ships include the radio receiver proper which receives on one frequency of 518 kHz, a printer and a microprocessor, operating on a given program. The microprocessor makes it possible to eliminate the repeated printing of transmitted data and print only those radiograms and especially selected service groups of words which correspond to preset programs of microprocessor operation. The receiver is fully automated and implements assured reception of messages up to 740 km away from the shore radio center.

The transmission and automatic reception of navigational and meteorological messages at a frequency of 518 kHz in the Baltic Sea was the first stage in developing the MPS "Navteks" world radio communications system. At present, this system also spans the North and Norwegian seas. Wider introduction of the "Navteks" system will make it possible to automate the reception of navigational and meteorological data by ships and will improve navigational safety.

Prospects of Radio Communications MPS Development

The use of the space system in the MPS to insure navigation safety and protect human lives on the seas. In spite of great efforts of national and international organizations on increasing the efficiency of radio communications

in helping ships in distress, the accident rate in the world fleet remains fairly high. In 1978-1980 over 750 ships with a gross tonnage of over 500,000 registered tons went down [22].

About 2000 people perished in world transport ships in accidents in 1978. The causes were different but in a number of cases they were due to the great delay in the detection and help of the ship. People died not only from hunger and cold, but frequently from nervous stress. The delay in helping was caused in many cases by the lack of information about the accident given to rescue services, or the coordinates of the location of the ship in distress.

In spite of the ships being equipped with modern radioelectronic navigational and communications devices, there are some cases where ships disappear for unknown reasons and in unknown places. In 1978-1980, the locations of 11 lost ships remained unknown. At the end of 1978 a large Liberian oil carrier, the "Berge Vanga" whose deadweight tonnage exceeded 220,000 tons disappeared with a 40-man crew while traveling from Brazil to Japan. A similar ship, the "Berge Istra" sank on a similar trip in 1975. The search for both ships was unsuccessful although it cost hundreds of thousands of dollars. The cause, apparently, was an explosion followed by the rapid sinking of the ship that did not permit the crew to send a radio distress signal.

Without doubt, the time and cost of search and rescue operations, as well as the probability of rescuing the people, depend greatly on the accurate determination of the coordinates of the location where the ship had the accident and on the efficent transmission of data on the distress to the rescue service.

As already considered above, the distress notification systems existing in the MPS at present specify the use of traditional radio communications facilities operating at frequencies of 500 and 2182 kHz and 156.80 megaHz. The operating distance of these facilities is very limited and usually does not exceed 100 to 200 miles. Recently emergency radio buoys (ARB) came into use in world practice. When activated they automatically transmit distress signals which are used to find the bearings of the ship in distress by radio direction finders of the search and rescue ships and aircraft. These ARB radiate at frequencies of 121.5 and 243 megaHz and have a detection range of about 100 km for aircraft and 15 to 25 km for surface ships.

The use of artificial earth satellites (ISZ) in an MPS space system for reporting purposes will make it possible to transmit emergency signals to shore coordinating stations from emergency apparatus, located at any point in the satellite zone. The APB signal must contain coordinate data of the ship in distress which must be automatically or manually introduced beforehand into the ARB memory [6, 22].

At present an experimental check of space systems is being made using geostationary as well as low-orbit ISZ.

Development of a space system based on using low-orbit ISZ is being carried out at present in parallel in the USSR, the United States, Canada and France according to an intergovernmental agreement on investigating and utilizing

space for peaceful purposes [22]. In this international program, the United States is represented by NASA, Canada -- by the Ministry of Communications, France by the National Center for Space Research and the USSR -- by the Minmorflot. The United States, Canada and France are working on the SARSAT project and the USSR is working on the KOSPAS (Space System for Searching for Ships and Aircraft in Distress) project. The combining of these two projects into a joint KOSPAS-SARSAT project is being implemented on the basis of the full coordination of the specifications of the systems, as well as the coordination of the start of ISZ and carrying out joint tests of the system, the mutual exchange of information, evaluation of efficiency and determination of ways to utilize it in the GMSSBB.

The KOSPAS-SARSAT system consists of four basic parts: ARB, designed to transmit distress information through ISZ KOSPAS-SARSAT at frequencies of 121.5 and 406.025 megaHz; ISZ launched in the USSR and the United States capable of accepting ARB signals and transmitting them at a frequency of 1544.5 megaHz to ground information stations (PPI) for subsequent processing; PPI which will be located in various countries and must provide for receiving ISZ signals from ARB and determine from the accepted signals the coordinates of the distress location; and control centers for the KOSPAS and SARSAT systems which serve to coordinate and control systems, as well as to exchange information [4, 22].

Distress messages, transmitted by ARB contain information about the country to which the distressed ship belongs, its type, name, nature of the damage and the time which has passed from the moment the ARB switched in. These signals are received by the ISZ and processed to determine the doppler shift in the ARB signal frequency, correlating it to the ship time, separate the information and form a new flow of information which contains the processed information received from the ARB. Immediately after processing, the information enters the main memory (OZU) and goes into the ISZ radio transmitter for relaying to the PPI. Information received at the PPI enters a special computer where the received information is sorted and processed in order to determine the ARB coordinates. Fig. 1 shows the configuration of the space search and rescue system, clarifying the principle of its operations.

Soviet and American ISZ will be used in the KOSPAS-SARSAT system. They are placed in near-pole orbits (83° and 1000 km; 97.6° and 850 km respectively). Within the framework of a joint project it is planned to launch two more Soviet and three more American ISZ [11, 22].

Three PPI will be installed in the United States (Illinois, California and Alaska), one in Canada (Ottawa), one in France (Toulouse) and three in the USSR (Moscow, Archangel and Vladivostok). They will have an operating zone which will practically span the northern hemisphere of the earth [9]. Fig. 2 shows the radio visibility of the Soviet ground information receiving stations located in Archangel and Vladivostok.

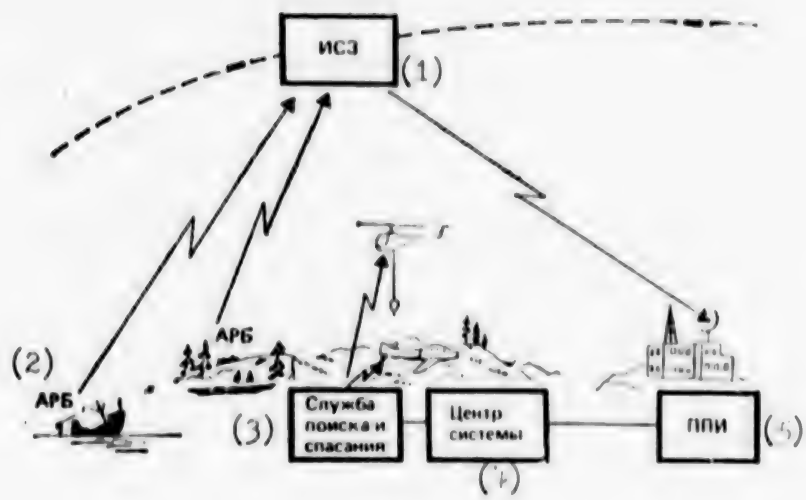


Fig. 1. Configuration of the space search and rescue system:
1 -- ISZ; 2 -- ARB; 3 -- Search and rescue service; 4 -- System center;
5 -- PPI.

Existing ARB, operating on the frequency of 121.5 megaHz, are used in the system, as well as are new experimental ARB, radiating at a frequency of 406.025 MegaHz. The ARB consists of a low-power (15 to 25 milliwatts) radio receiver, radiating at a frequency of 121.5 megaHz, designed to bring the rescue facilities to the ARB.

The control center of the Soviet part of the system is located in Moscow, the American center is in St. Louis (Illinois), the Canadian is in Ottawa, and the French is in Toulouse[22]. The "Telex" network is used for communications between the control centers.

After completing the joint KOSPAS and SARSAT experiment, joint recommendations will be prepared on the creation of an operational satellite system for search and rescue, and a decision will be adopted about transferring the experimental system into pilot operation.

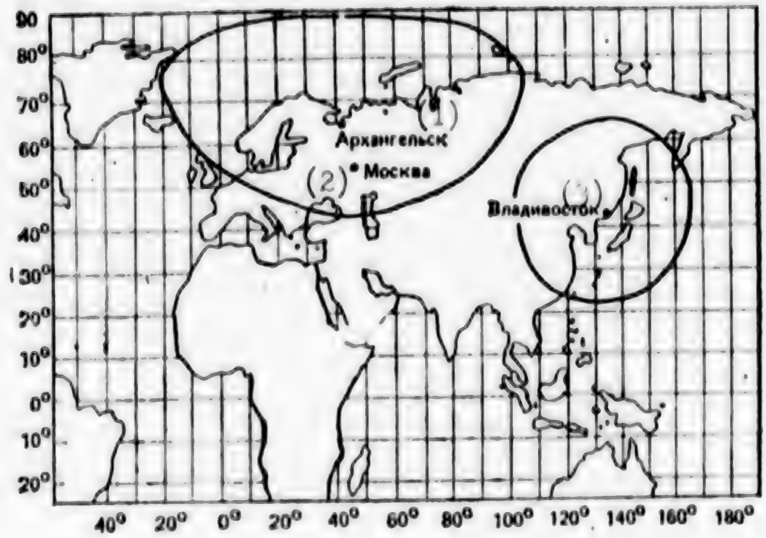


Fig. 2. Radio visibility zones of ground PPI in Archangel and Vladivostok
1 -- Archangel; 2 -- Moscow; 3 -- Vladivostok.

The first ISZ "Kosmos-1383" in the KOSPAS-SARSAT was launched in the USSR on 30 June 1982 (PRAVDA No 218, 6 August 1982). By launching the "Kosmos-1383" satellite, the Soviet Union made another important contribution to international cooperation and laid the basis for the practical realization of the KOSPAS-SARSAT system created in the interests of all peoples in the world. During the period between 10 September and 10 October 1982, "Kosmos-1383" determined the coordinates of four distress locations -- three aviation catastrophes (two in Canada and one in the United States) and one marine catastrophe in the North Atlantic near the shores of the United States. The second ISZ "Kosmos-1447" was launched on 24 March 1983 (PRAVDA No 85, 26 March 1983). The first ISZ in the United States SARSAT-OAA-8 system was launched on 28 March 1983.

Basic characteristics of global marine communications system for reporting distress, and insuring navigational safety. Recommendations with requirements that must be met by the GMSSBB have been considered by the IMO for several years and were adopted after assigning frequencies for GMSSBB needs in VAKR-83 [11]. Here recommendations are being developed for a minimum list of radio communications apparatus for various ships. It was stressed that this list must be determined not by the tonnage of the ship but by where it navigates. The basic requirements of the GMSSBB are as follows: no matter where the ship is, it should receive ship to ship distress signals at all frequencies assigned to the GMSSBB, provide radio communications in the distress (accident) zone and get the bearing of the ship in distress; be able to transmit ship to shore signals about the distress and transmit (radiate) signals for direction finding by at least two different and fully independent radio facilities; should be able to receive shore to ship warnings about distress and transmit distress warning signals ship to ship by at least one radio device; be able to participate in radio communications in search and rescue operations; transmit and receive navigational warnings, maintain radio communications with national and international shore networks and systems; maintain bridge to bridge radio communications (in the meter range between operators who control ships in restricted regions); use ARB, freely separated from the ship, to transmit distress and bearing signals [10, 11].

To limit the number of radio facilities installed aboard ship it is possible to combine the execution of various functions in one radio facility but, at the same time, all requirements with respect of having two different and independent radio facilities must be met.

Moreover, it should be stressed that the GMSSBB will differ from the existing communications subsystem in distress situations in that manual telegraphy using Morse code and radio telephony will not be used; printers or data exchange of preprinted messages will be fully automatic to eliminate (reduce) human errors.

As shown by experience the development of new international regulations is being implemented slowly, and the development, verification and coordination of final recommendations will take several years; therefore, it may be expected that the GMSSBB will begin to be introduced in 1988-1990. Both the existing subsystem as well as the GMSSBB will be utilized during the transition period.

Use of space channels for radio communications with MPS ships. The INMARSAT international satellite communications system, based on the SSS MARISAT system [4, 23], was officially put into operation on 1 February 1982. It is a system of earth satellites used to relay messages between ships equipped with special facilities and special shore radio stations, connected by national and international communications lines with shore subscribers. This system will provide duplex telephone and telegraph radio communications, data and facsimile transmission as well as transmissions of distress, urgent and safety messages.

Satellites used in the USSR are rented by the INMARSAT organization from contractors; shore radio stations belong to the countries in which they are located; ship radio stations belong to shipowners.

The INMARSAT is controlled by an international organization carrying the same name. This organization was established according to a convention signed by a number of interested countries. At present it is financed by 36 countries which have signed the convention. In the future, as the system is being developed, its economic basis will be payments from ship and shore subscribers for services rendered.

Geostationary satellites located at fixed points 36,000 km above the equator are being used in the INMARSAT system. Each one spans some zone in which there are a certain number of serviced ships and several shore radio stations, one of which executes the function of a coordinator. Any ship radio station can be connected to the required subscriber through any shore station in the given network. Initially three geostationary satellites of the American MARISAT system, which span the Atlantic, Indian and Pacific oceans (Fig. 3), operate in the INMARSAT system.

Specialized MAREKS-A and MAREKS-B satellites, developed by the European Space Agency and INTELSAT-U, developed by the Comsat General Corporation (United States), were launched to replace MARISAT satellites already in orbit since 1976. The capacity of MAREKS satellites will be equivalent to 40 telephone channels, while the capacity of retransmitters for MPS radio communications, installed on the INTELSAT satellites, will be equivalent to 30 telephone channels. Each oceanic region is constantly serviced by one active INMARSAT satellite and has one reserve satellite in orbit. The nominal service life of each satellite is 7 years.

Shore radio stations in the INMARSAT serve as an intermediate link between the satellite and shore subscribers to which they are connected by international and national networks. A typical shore radio station includes an antenna with a parabolic mirror 10 to 13 meters in diameter, a radio receiver and transmitter, a processor and a device for coupling to ground communications circuits.

Below are listed shore radio stations in the INMARSAT system already in operation or in process of construction, and the regions they serve [23]:

Odessa, USSR	Atlantic, Indian
Goonhilly, Great Britain	Atlantic
Fuchino, Italy	Atlantic
Plemer-Bodu, France	Atlantic
Tangua, Brazil	Atlantic
Southberry, United States	Atlantic
Um-Al-Aish, Kuwait	Atlantic
Ayk, Norway	Indian
Yamaguchi, Japan	Indian
Hongkong	Pacific
Ibaraki, Japan	Pacific
Santa Paula, United States	Pacific
Singapore	Pacific

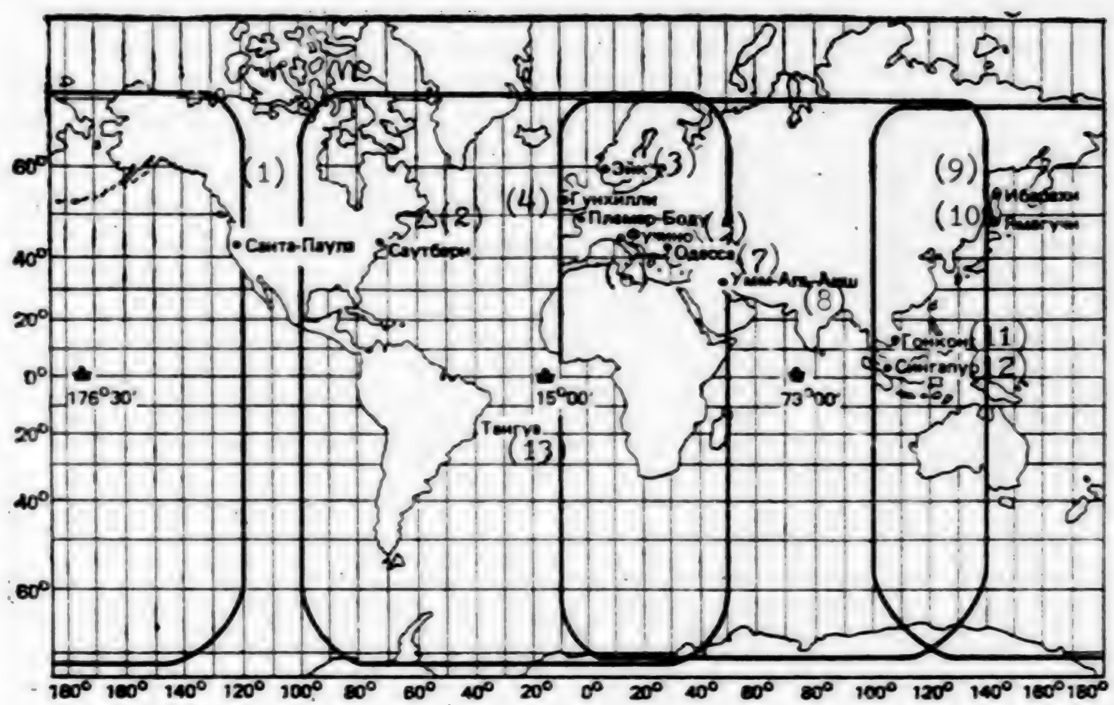


Fig. 3. Regions of the earth surface spanned by INMARSAT system satellites.
1 -- Santa Paula; 2 -- Southberry; 3 -- Ayk; 4 -- Goonhilly; 5 -- Plemer-Bodu; 6 -- Fuchino
7 -- Odessa; 8 -- Um-Al-Aish; 9 -- Ibaraki; 10 -- Yamaguchi; 11 -- Hongkong; 12 - Singapore;
13 -- Tangua

The areas' coordinating radio stations are located in Southberry (Atlantic Ocean area), Yamaguchi (Indian Ocean region) and Ibaraki (Pacific Ocean area).

A typical ship radio station for a standard A satellite communications system consists of an electronic unit located in an enclosed space on the ship, a teletype and a control unit (usually combined with the teletype) an antenna mounted on a pole or special column on the upper deck of the ship. The electronic unit contains a frequency synthesizer, amplifiers, power supplies and a microprocessor. Telephone and telegraph, data transmission and facsimile apparatus are connected to the electronic unit.

The antenna unit of the radio station contains a parabolic antenna with a 1.2 meter mirror. The radiation pattern of the antenna is -10°. The antenna has an automatic two-axial stabilization system that compensates for the roll and pitch of the ship and and automatic two-axial beam homing on the satellite along the azimuth and the angle of elevation. The antenna together with the stabilization and homing systems are covered with a radio-transparent cap. Over 10 foreign firms now manufacture standard A radio stations. A ship radio station transmits in the 1635.5-1645.0 megaHz frequency band and receives in the 1535.0-1543.0 megaHz frequency band. The power radiated by a ship radio station is 25 watts per channel.

At present, there are only standard A radio stations on ships. By the end of 1981 over 900 ships of MPS all over the world were equipped with satellite standard A radio stations, while now over 2500 ships already have them. At present, 20 ships in the Soviet Union have satellite radio stations.

STATUS, FUTURE DEVELOPMENT OF ELECTRICAL COMMUNICATIONS IN AVIATION

[By Al'bert Andreyevich Kuznetsov, doctor of technical sciences, professor. Published 50 scientific papers, among them three books; and by Oleg Stepanovich Nabatov, candidate of technical sciences, lecturer. Published 30 papers, including four books]

Civil aviation is a modern sector of the national economy and is a component part of a single transportation system in the country. Safe and regular flights, which are the most important indicators of Aeroflot operation, are provided by radioelectronic systems and computers combined into automatic traffic control systems for aviation (AS UVD). Air traffic controllers of AS UVD centers receive information about the air traffic from radar and radio navigations systems, process it by computers and make decisions on aircraft flights. All information on air traffic control is transmitted over electrical aircraft communications.

Electrical aircraft communications were the first radioelectronic means for use in flight control. They were developed almost simultaneously with domestic aviation.

In July 1899, four years after the invention of radio, A. S. Popov and his associates P. N. Rybkin and D. S. Troitskiy, transmitted radiotelegraph signals from a balloon to the ground. On 22 (9) November 1911, D. P. Sokol'tsov,

a Lt. Col. in the Russian army transmitted radio telegraph signals for the first time in the world from an airplane piloted by A. V. Pankrat'yev, to the ground -- a distance of up to 20 km. This date became the birthday of electrical aviation communications.

In 1921, under the guidance of A. I. Kovalenkov, the first Soviet AK-21 airplane radiotelephone transmitter was developed, while in 1923 -- an AK-23 was developed with a range of up to 50 km. More and more attention was paid, in the following years, to the development of electrical aviation communications. New aircraft and ground radio stations were developed and their series production was organized.

In 1935 the Novosibirsk-Kemerovo aerial line was fully equipped with radiotelephone communications. In 1938, the RSI-3 radiotelephone aircraft station with a range of up to 100 km was developed.

Equipping planes and aerial routes of civil aviation with radio communications stations and other radioelectronic facilities had a significant effect on the entire system of aviation control. In 1930, aerial routes were divided into dispatcher zones. Then flight regulations and a methodology for aviation control, using radioelectronic facilities, were developed.

In postwar years, electrical aviation communications, radar and radio navigation facilities were improved further. Problems solved by these facilities in the process of aviation control also expanded. Airborne and ground systems for aviation communications, radar and radionavigation were created. Qualitative changes in aviation radioelectronics began in the sixties on the basis of the digital processing of signals and third generation computers. In the seventies, microprocessors opened up new possibilities for the direct use of computers in radioelectronic devices and systems.

Radioelectronic aviation devices and systems developed in the fifties and sixties made it possible to solve basic problems in aviation control. Qualitative changes in all aviation equipment also began in those years. The appearance of multiseat jets and turbojet planes on aerial routes and the great increase in flights led to a considerable increase in the dispatcher control load. The dispatchers became the weakest links in aerial movement control, their low labor productivity reduced the transit capacity of aerial routes, while high overloading reduced flight safety. Thus, the increase in the number of planes and greater safety and flight regularity requirements led, at the end of the sixties and the start of the seventies, to the necessity of solving new problems and finding new ways to organize aviation control. These problems began to be solved by automating aviation control on the basis of the new generation of radioelectronic equipment and computers.

Radioelectronic devices and computers were given the functions of digital processing of signals, controlling the operation of individual devices and systems and diagnosing conditions. This made it possible to increase the quality and reliability of the radioelectronic equipment. The automation of aviation control processes led to the combination of electrical communications, radar, radio navigation and computers into an automatic system for

navigation control (AS UVD). Thus, for almost 60 years, aviation radioelectronics proceeded along the path of its differentiation, while in the seventies it became advisable to integrate it at a new qualitative level to solve new problems in controlling aviation and operating aviation equipment.

Electrical aviation communications systems are a part of the radioelectronic complexes and the AS UVD of civil aviation, as well as of the general state communications network. Therefore, both have an effect on the condition and development of aviation electrical communications. The following have basic effects on the development of aviation electrical communications: the introduction and development of the AS UVD; design and development of a single civil aviation communications network and the introduction of digital transmission systems and integrated digital communications networks; the development and introduction of electrical communications and systems using computers.

Data transmission in the AS UVD in the future will consist of an exchange of data between computers aboard aircraft and the ground. The planes may be considered as subscriber AS UVD centers, while AS UVD communications systems may be considered as computer communications systems.

The development of aviation communications systems proceeds in the direction of integrating data sources, terminal devices and channels into a single integrated network.

The introduction of digital systems in aviations communications made it necessary to change over to digital methods for signal transformation. For analog signals it is pulse-coding and delta-modulation, while for discrete signals it is single and multiple relative phase modulation.

The use of microcomputers and microprocessors changed all aviations communications equipment to a new qualitative level. Algorithms for devices and systems for communications can be realized by apparatus, program or apparatus-program methods. Communications devices and systems become multiprocess and multilevel, and become closer in architecture and functioning to computer devices and systems.

The component base of aviation communications equipment is changing. Integrated microcircuit systems replaced entire stages and units of communications devices, provided for their microminiaturization, opened up wide possibilities for designing units and devices in the form of plates, eased the diagnostics of the equipment and replacement of defective plates by good ones considerably.

The especially noted features in the development of aviatic s communications equipment have already had a significant effect. Aviation communications networks are being developed using IKM-15 and IKM-30 digital transmission systems; "Kvant" channel switching centers and DS6-400 message switching centers using minicomputers acquired in France; "Elektronika-NTs-32" telegraph concentrators with "Elektronika NTs-OZD" microcomputers; control panels for operational communications, automatic stations for dispatcher communications

using "Elektronika-60" microcomputers; displays and teletypes using micro-processors. Work is being done on developing an integrated civil aviation digital communications network using rented and departmental digital channels, as well as "Istok" switching units. New radio stations of aviations communications "Polet-1" "Polet-2" and "Orlan-TS" are in operation. They transmit data over a voice frequency channel by a modem with a minimal frequency modulation without a break in the phase.

The examples cited indicate that new aviation communications equipment is being developed on the basis of digital signal processing and computers. Automatic aviation communications facilities with remote control according to given programs are being developed using these devices.

Modern aviation communications have become one of the basic means for guiding the activity of civil aviation.
Aviation communications include: issuing information about the plane flight to passengers, boarding, arrival, as well as transmitting recreation-musical programs in planes and waiting rooms at airports. The basic purpose of aviation control, however, is to control aviation and flight safety. According to its purpose, aviation communications are divided into aerial and ground aviation.

Aerial aviation is for air traffic control (UVD). It is organized according to the control structure shown in Fig. 4. The main flight control center implements the general control of aerial aviation. The territory of the country is divided into zones within which zonal centers of the UVD system plan the flights. Flights within each zone are controlled directly by regional AS UVD. Several dispatcher posts are located within airports such as: arrival, boarding, circling, starting and taxiing. These dispatcher posts control flights within their sections. Regional center dispatch posts exchange messages with airplane crews over radio communications centers in the meter and decameter wave ranges, as well as with adjacent dispatcher posts over liaison channels.

Each dispatcher post has its own radiocommunications channel with aircraft. To communicate with the dispatcher the pilot switches from the channel of the radio station on board to the working frequency of the ground radio station of the dispatcher post.

Pilots and dispatchers use an approved phraseology to exchange messages. On the average such messages are exchanged once every 15 minutes. Message conversation time is 30 to 60 seconds. If it is assumed that the control zone of one dispatcher contains 10 planes, the dispatcher must talk to pilots every 1.5 minutes on the average. In this case, the dispatcher would be greatly overloaded which, in the final account, may lead to a reduction in flight safety. This problem is being solved by automating flight control systems and an automated system for the exchange of flight information.

Essentially, ground aviation communications are similar to production communications, and all types of radio and wire communications are used to transmit data, displays and documents.

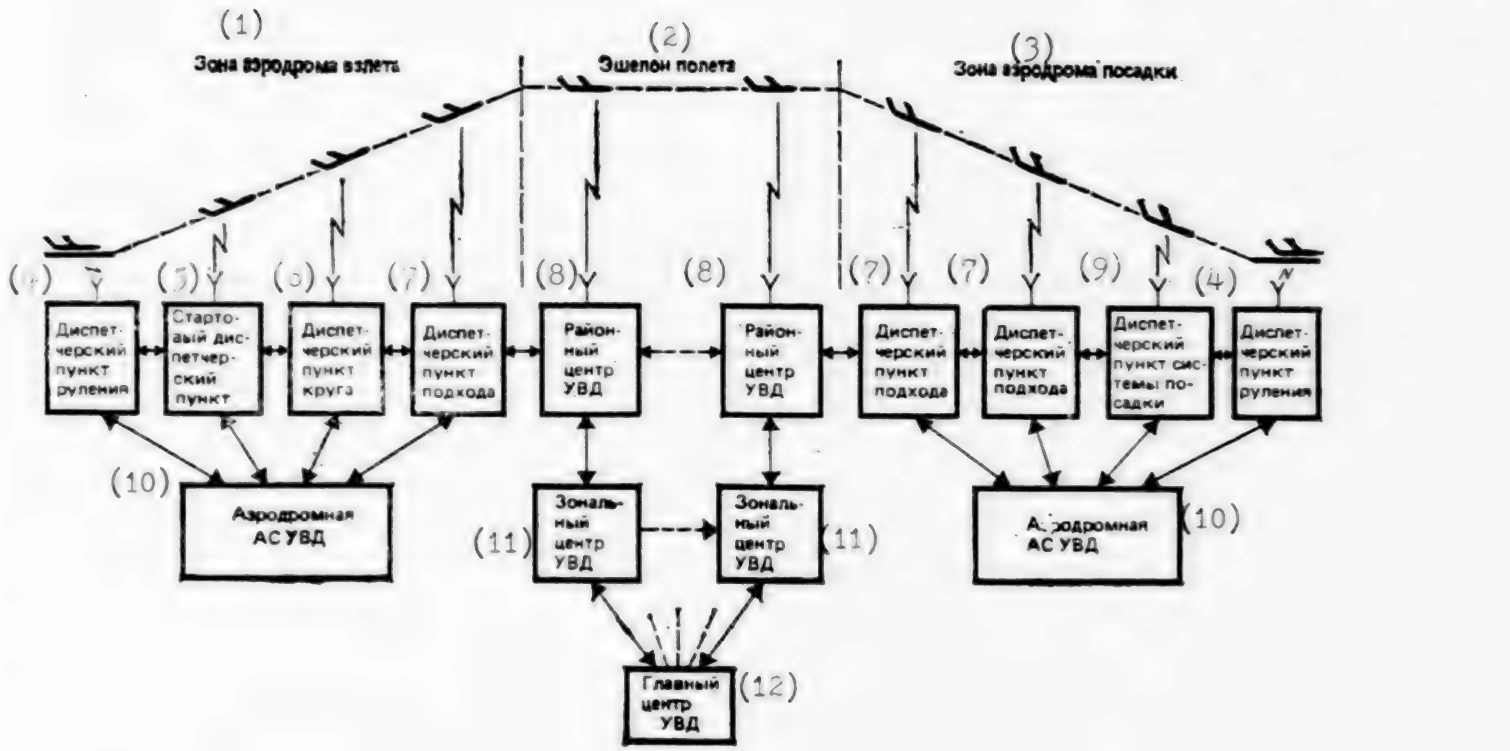


Fig. 4. 1 -- Airport take-off zone; 2 -- Flight level; 3 -- Airport landing zone; 4 -- Taxiing dispatcher post; 5 -- Starting dispatcher post; 6 -- Circle dispatcher post; 7 -- Arrival dispatcher post; 8 -- Regional UVD center; 9 -- Landing dispatcher post; 10 -- Airport AS UVD; 11 -- AVD zonal center; 12 -- Main UVD center

The basic production process in civil aviation is flight control. As mentioned above, an automatic flight control system has been developed. The first AS UVD were placed in operation in 1981 in Moscow, Kiev and Mineral'nyye Vody. The AS UVD development proceeded on the basis of the airport "Start," airport group "Start-2" and regional "Strela" AS UVD. Their basic components are AS UVD centers and radio equipment systems (RS) for flight control which contain: radar sites, or complexes, radio direction finders, receiving-transmitting centers and dispatcher control posts.

Airport AS UVD controls flights in the airport zone within a radius of 100 to 150 km. Airport group AS UVD controls the flights of several airports. For example, the Moscow group contains four airports: the "Vnukovo," "Sheremet'yevo," "Domodedovo" and the "Bykovo." Regional AS UVD control flights in an area from 300,000 to 1 million square kilometers.

Powerful primary and secondard long range radar are used in the AS UVD regions.

Secondary radar upon inquiry receives flight data in digital form from airplanes. This information is transmitted over communications channels to the flight control center, processed in a computer and indicated in digital-table and coordinate-digital form at the work positions of dispatchers. Regional AS UVD can control the flights of up to 325 planes simultaneously. This increases flight safety and reduces the dispatcher load.

The aircraft send radar signals with flight information over secondary radar channels to radar sites or complexes, where they are converted into data signals and transmitted with a speed of 2400 bits/second over wire voice frequency channels to the Moscow AS UVD center. Voice signals and data (formalized voice messages, operational information etc.) from planes are transmitted over voice frequency radio channels to ground radio stations and further over wire channels to the Moscow AS UVD center. Receiving and transmitting communications centers have meter and decameter range radio stations.

As AS UVD centers are complicated complexes consisting of radio electronic systems and computers, to operate such a complex it is necessary to have external communications with radar sites and adjacent disptacher posts as well as internal communications with dispatchers of the sectors of the AS UVD center. Radio and wire communications are used for external communications. Radio communications are implemented through meter range radio stations and satellite communications systems.

AS UVD communications networks are made up basically of rented and departmental voice frequency channels and, at present, also of digital channels using the IKM-30 digital transmission systems. Work is also being done to create a single civil aviation communications network as the first stage in building an integrated digital communications network (ITsSS GA).

The ITsSS GA synthesis must solve fully the problems of providing communications to all civil aviation flights on international, domestic, long distance and local airlines, as well as helicopter flights used in agriculture and when doing construction and installation work.

Of special importance are problems of organizing communications between planes and dispatcher posts in the northern regions of the country and when flying at low altitudes. Under such conditions radio communication in the basic meter wave range is not always possible and satellite communications systems become very important. Therefore, in synthesizing ITsSS, communications channels, optimal for specific network conditions, will be used.

The structural arrangement of an integral digital communications network for civil aviation is shown in Fig. 6.

The integral digital communications network transmits voice signals and data by packet switching methods. According to the structural arrangement of flight control, shown in Fig. 4, a main center for packet switching is installed in the main center of the UVD system, a zonal -- in the zonal; and a regional -- in the regional packet switching center. The flows in the integrated digital communications network are controlled by a multilevel multiprocessor computer system. The first level of the computer system is located in the main packet switching center, the second -- in the zonal, and the third -- in the regional.

The computer system processors at each level of flows control exchange data through respective packet switching centers over digital communications channels, organized with the help of the IKM-30 and IKM-120 digital systems.

Regional centers of the UVD system interact over ground aviation communications channels with all services involved in plane flights and over aerial aviation channels -- with planes in the air within a given regional center.

On aerial routes, northern and other regions where there is no field overlapping of meter range radio stations, radio communications in the decameter range are used, as well as the most promising radio communications of satellite communications systems.

The "Orbita" satellite system, based on the "Molniya-1" and "Molniya-3" Soviet satellite systems, includes more than 100 stations and the "Intersputnik" international system. The "Intelsat" satellite communications systems that unite over 80 countries operates abroad. The accumulated experience in using satellite systems produces a good basis for creating a satellite communications system for civil aviation. Such work is being done in the Soviet Union and abroad.

There are various versions of building such systems. For example, Fig. 6 shows a decentralized system in which aerial routes are divided into several regions with their own ISZ. For technical-economic considerations, ground satellite communications systems are located in one of the regional UVD centers and service a group of adjacent regional centers through regional and zonal switching centers and digital communications channels. Signals from planes enter a ground satellite communications system complex through the ISZ and are transmitted further to UVD dispatchers over ground channels. Signals are transmitted from the dispatcher to the plane in reverse order.

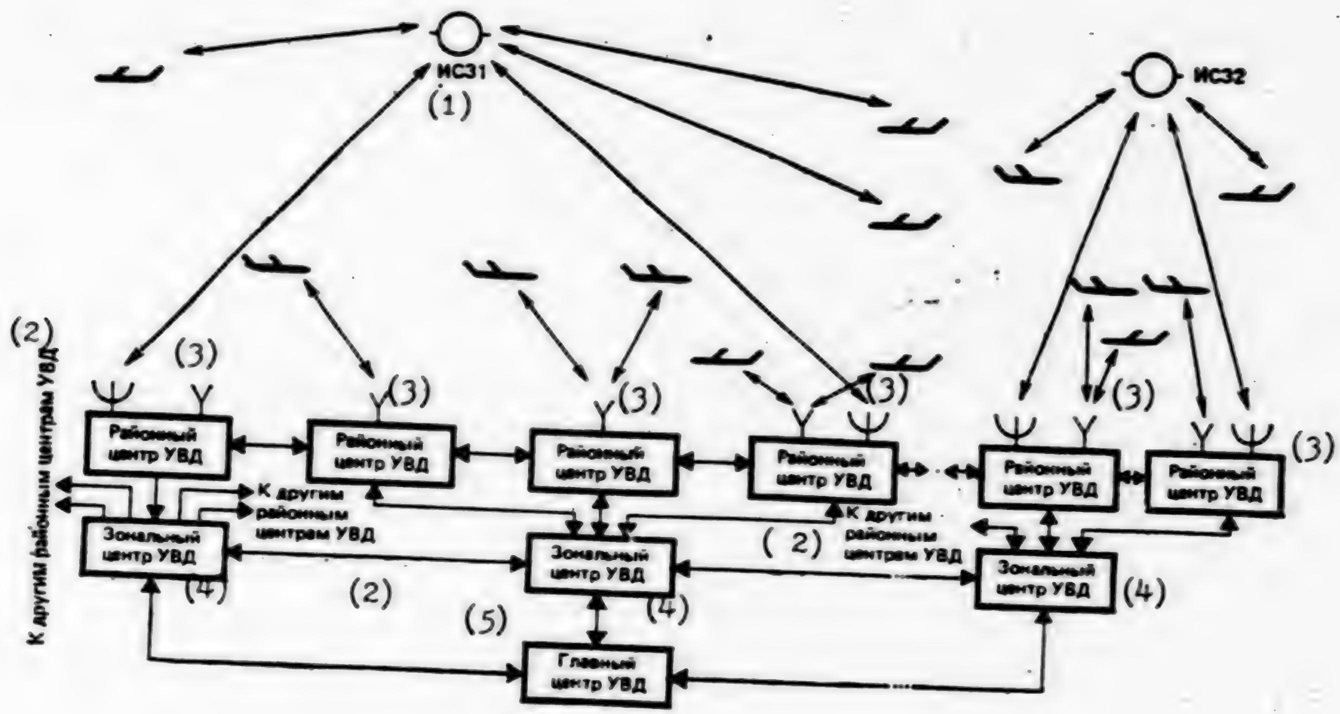


Fig. 6. 1 -- ISZ1; 2 -- To other regional UVD centers; 3 -- Regional UVD center; 4 -- Zonal UVD center; 5 -- Main UVD center

Civil aviation satellite communications systems are generally designed to operate through the ISZ. However, there are also specific differences.

First is the use of a multistation access method with one dispatcher post for servicing several planes. Now each dispatcher is assigned his own radio communications channel. All planes within the zone of responsibility of a given dispatcher establish communications with him. All plane crews, operating on a given channel, hear the conversations and when it is necessary to transmit an urgent message so inform the dispatcher.

Second is the use of certain servicing rules for the realization of multistation access.

Such servicing rules receive great attention in developing digital and integrated digital communications networks. One such version was proposed by A. A. Kuznetsov and A. V. Prokhorov [1]*.

According to recommendations of the international civil aviation service contact between the dispatcher and pilot must be established in 3 seconds. This time is divided into access time and signal transmission time. The access time has two windows for urgent and four windows for nonurgent messages with a total time of 1 second, i.e., at a data transmission speed of 2400 bits/second, it is possible to transmit a message of about 5000 bits which is several times the average length of a message in aviation communications channels. The ground complex of the satellite communications system determines that there is a request by planes for communications by cyclic inquiry. When there is a request its priority is determined. If a channel is free, the type of communications is determined, i.e., whether it is voice or data transmission.

In voice communications the ground complex instructs the plane on the start of transmission. The received transmission is directed to the address indicated in the request. The request for transmission is also included in the data transmission. After the message is received, the error protection device verifies correct reception by verification of the message. If there is an error in the message steps are taken to correct it. If the number of errors exceeds the correction capacity of the error protection device, a repeated transmission is requested. A message received without errors or a message with a corrected error is transmitted to the address indicated in the request.

Third is the necessity of providing the necessary power to satellite channels of the integrated digital civil aviation communications network. Of two sections "ground station-ISZ" and "ISZ-plane" the second section has poorer power conditions, especially in the plane to the ISZ direction. The power of modern ISZ transmitters is several tens of watts, while the plane antenna amplification is one or several decibels. Under these conditions it is difficult to provide the necessary signal-to-noise ratios at the input of the plane receiver. This has an especially great effect when transmitting high speed digital signals.

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*Sources cited at end of book

To increase the signal to noise ratios it is necessary to reduce the transmission speed of digital signals, increase the power of the ISZ transmitter, increase the amplification of the plane antenna or use wide-band signals with a large base.

Fourth is the use of digital radio stations. The fact is that analog radio stations used at present provide communications between the dispatcher post and several planes on one voice frequency channel. In digital systems with multistation access it is necessary to use multichannel digital radio stations with time division channels. The realization of algorithms for servicing rules in digital radio stations must be implemented by processors.

The problems of realizing satellite communications systems are being solved at present and their use in integrated civil aviation digital communications networks will already be possible in the last decade of the twentieth century.

Message transmission over ITsSS channels brings up still another problem which did not originate in analog communications systems. The problem of utilizing ITsSS channels is reduced to solving problems of loading general channels with various message and channel traffic control. The solution to the first problem is reduced to developing formats for messages, while the second -- to developing procedures for channel control.

It has already been mentioned above that in automatic flight control systems planes are like mobile subscriber points of AS UVD centers. The planes are independent facilities and work is being done to develop ITsSS aboard planes [2, 3, 4]. Special features of the ITsSS aboard planes are their compactness and the possibility of building them with computers on board.

The structural arrangement of the integrated digital communications network aboard planes is shown in Fig. 7. It consists of a system of central processors (TsP), an access system and functional systems.

The central processor system has several processors operating in the parallel mode or in the load division mode. Usually from two to four central processors are used on planes. In the parallel mode, all central processors operate on reception and only one on transmission. When one central processor fails, its function is taken over by one of the central operating processors according to a given program. If it fails, its function will be executed by the next central processor. In this way, there is a two-fold, three-fold or four-fold standby. In the load division mode, each processor executes a part of the functions. If one of the central processors fails, the load is distributed among the remaining central processors according to a given program. When another central processor fails, the load is again redistributed among the operating central processors. Here there is also a two-fold, three-fold or four-fold standby of central processors. But unlike the previous mode, in this case, the central processors do not operate at a full load, which extends their lives. Therefore, this mode of operation is more promising for ITsSS aboard planes.

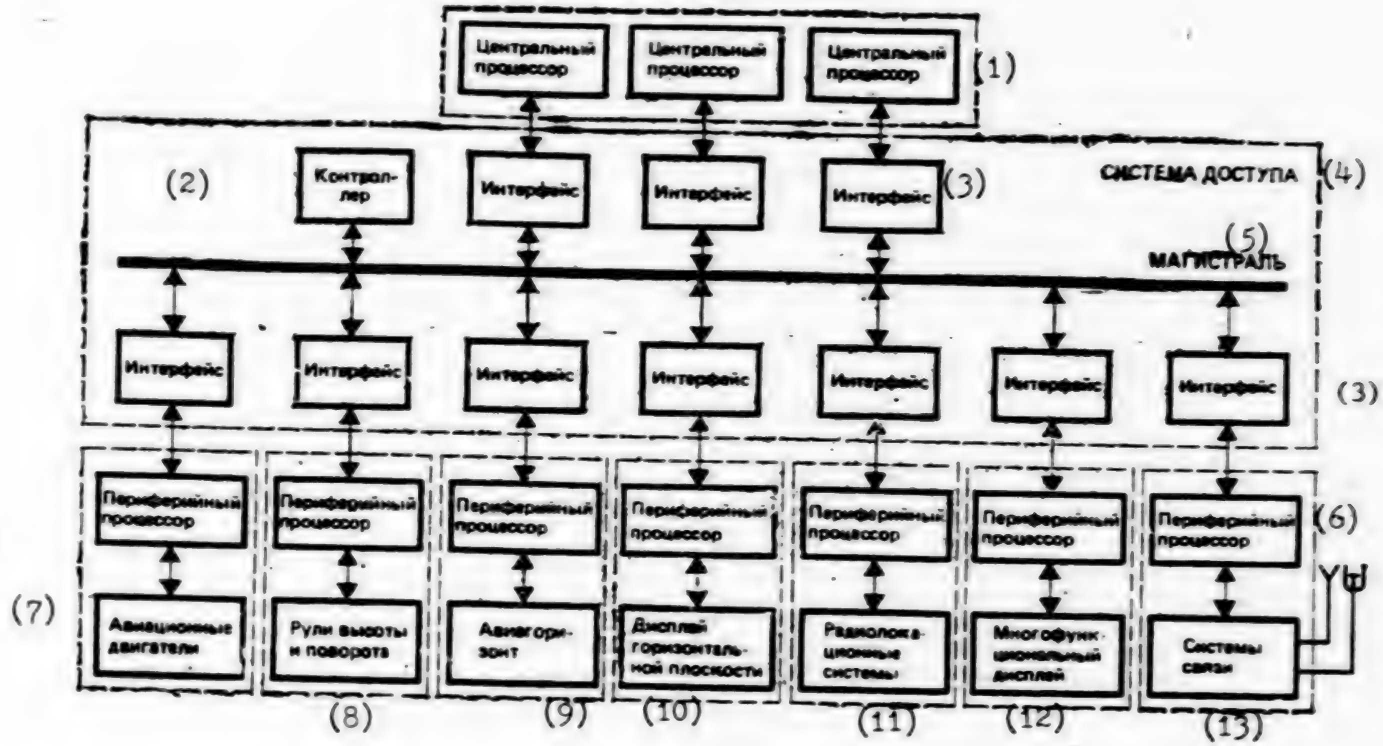

Fig. 7. 1 -- Central processor; 2 -- Controller; 3 -- Interface; 4 -- Access system; 5 -- Main trunk; 6 -- Peripheral processor; 7 -- Aviation engine; 8 -- Altitude and rudder control; 9 -- Display of ground parallel; 10 -- Display of horizontal plane; 11 -- Radar systems; 12 -- Multifunctional display; 13 -- Communications systems.

The access system consists of the main trunk, interfaces and a controller.

The functional systems contain: a system to control aircraft engines, a system for altitude and rudder control, a system to display the ground parallel and a display of a horizontal plane, a multifunctional display system, a radar system and a communications system.

Systems for controlling aircraft engines and for altitude and rudder controls enable the execution of the plane's flight according to a given program with optimal trajectories for take-off, flight and landing. The system for displaying the ground parallel makes it possible to guide the plane according to the aerial route program. The display shows the position of the plane with respect to the aerial route and the territory flown over. The radar system serves to determine the surrounding space and interaction with secondary radar systems. The multifunctional display is the identification of the aircraft cockpit terminal and is used for input and output data to the ITsSS aboard the aircraft and, through it, to aviation communications. The communications system is designed to exchange messages over outside and inside communications channels of the aircraft as well as for transmitting information to lounges on planes. The devices of the functional system consist of peripheral processors and the devices they control.

The communications systems consist of communications subsystems in the meter and decameter ranges, a satellite communications subsystem, an in-plane communications subsystem and a subsystem to transmit information to plane lounges. The subsystems for outside radio communications have voice and data transmission modes. The data are set up on the multifunctional display. The peripheral communications processor presents the set-up message in the shape of a format and then transmits it through one of the outside communications channels.

All functional systems are sources of information transmitted over the integrated communications network aboard the aircraft by an 8-bit code, and processed in the computer on board. Optical cables are coming into use for digital data transmission.

The ground and aircraft integral digital communications networks have terminals installed at UVD at UVD dispatcher posts and in aircraft cockpits. These terminals are essentially subscriber points which are designed taking into account the specifics of the dispatchers [air traffic controllers] and pilots.

At present AS UVD center dispatchers exchange data with computers by using keyboards and displays, which is unproductive and causes loss of working time. This is of special importance to pilots. To increase the productivity of labor of dispatchers and, therefore, the transit capacity of aerial routes, voice communications with the computer can be used. In this case, input and output data to and from the computer may be executed in the shape of a voice symbol no matter what form the inquiry takes. For this it is necessary to program the computer to understand the question posed in voice or symbol form, prepare and issue the answer in voice or symbol form. Man-computer dialogue

in the symbolic form is fairly well developed and is used in various systems of civil aviation. Certain positive results have already been obtained in voice communications between man and computer. Devices for voice communications with computers that have a limited 20-word dictionary are being used in our country and abroad. Investigations are being made into the use of these devices in aviation communications systems.

Of still greater importance is the prospect of man communicating with a computer through the conversion of "speech to letters." The fact is that, on the average, a man pronounces about two five-letter words per second. Five bits are required to code each letter. Then such a message could be transmitted at a fairly low speed of 50 bits/second. This is of great importance for satellite communications channels, because it will make possible increased power of the transmitted signals and the signal-to-noise ratio at the input of receiving devices with the power of the ISZ transmitter and aircraft antenna amplification that exist at present.

Computers and the digital processing of signals will be used not only in the future, but are already being used in present devices and communications systems. The automatic "Strela" station for dispatcher communications with program control was developed and is being introduced for AS UVD centers. An operational communications control panel with delta-modulation signals and program control is being developed and will be placed in operation at the start of the 12th Five-Year Plan period.

The automatic dispatcher communications station was designed for regional UVD centers and provides for inside communications between dispatchers and UVD centers, as well as between dispatchers of various UVD centers and through radio stations between dispatchers of the control centers and crews of planes. This station along with the communications control panels at the work positions of dispatchers, provides for the following: two-way operational communications between each dispatcher and any inside subscribers of dispatcher communications by dialing an assigned number; two-way operational communications between each dispatcher and any other inside or outside program assigned to the given control panel subscriber, by pushing the named key; conference call communications between a certain category of dispatchers of two to 30 previously selected subscribers; conference call communications between a certain selected group of dispatchers for stations of any productivity with eight inside or outside subscribers, selected by pushing named keys on the control panels; operational radio communications between a certain group of dispatchers and plane pilots through any of the radio stations program-assigned to a given control panel; retune radio stations for the UVD dispatchers outside the routes to any of 10 fixed waves; priority in setting up a connection with a preliminary notification by a special signal of disconnection; notification by a special signal of busy subscribers of new callls waiting for them; place requested connections on hold until the called subscriber is free or for a given time; temporarily block subscriber lines and established connections when communications are needed for a third subscriber with a later return to previous communications.

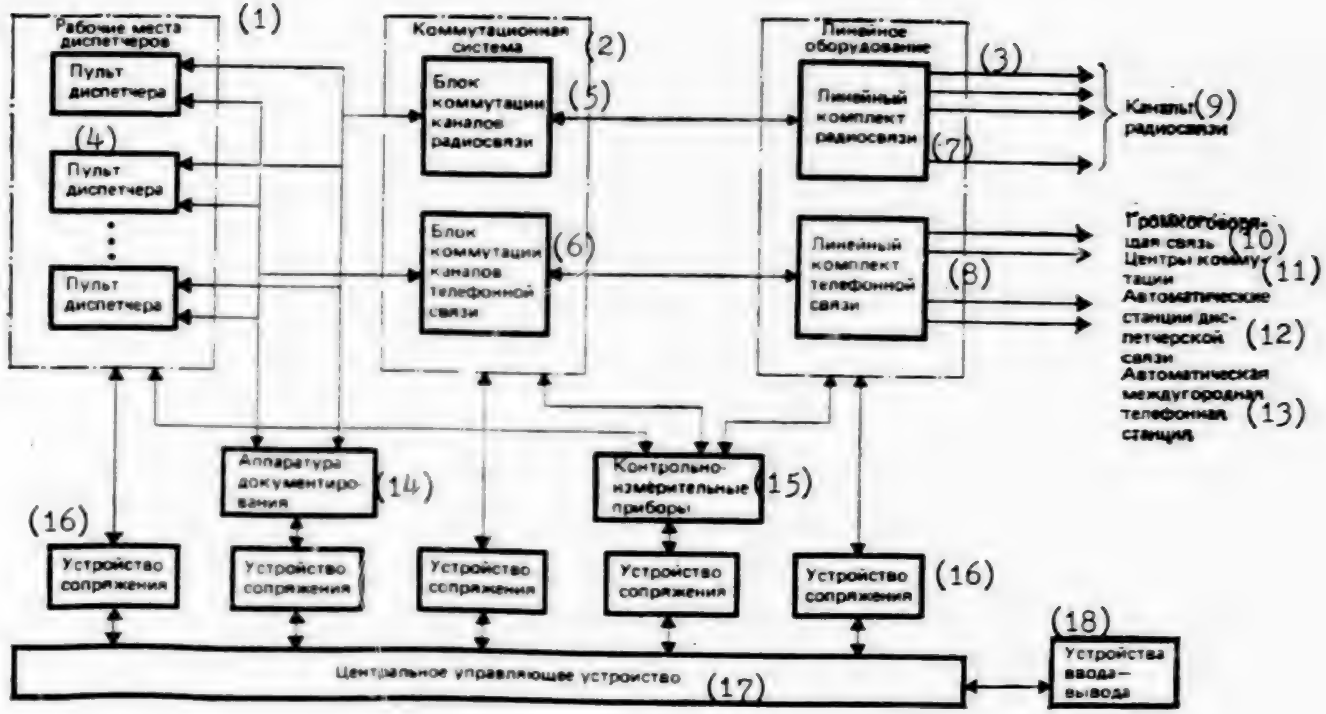

Fig. 8. 1 -- Dispatcher work positions; 2 -- Switching system; 3 -- Line equipment; 4 -- Dispatcher control panel; 5 -- Radio communications channel switching unit; 6 -- Telephone communications channel switching unit; 7 -- Line radio communications set; 8 -- Line telephone communication set; 9 -- Radio communications channels; 10 -- Loudspeaker communications; 11 -- Switching centers; 12 -- Automatic dispatcher communications stations; 13 -- Long distance telephone stations; 14 -- Printers; 15 -- Monitoring-metering equipment; 16 -- Coupling equipment; 17 -- Central control installation; 18 -- Input-output device.

Fig. 8 shows the block diagram of an automatic dispatcher communications system. The station consists of work positions for dispatchers, a switching system with radio communications and telephone communications units, line equipment with line sets for connecting radio and telephone communications, a central control installation with coupling and input-output devices, printers and a monitoring-metering control panel.

On his control panel, the dispatcher can set up communications with subscribers over radio and telephone communications channels. The dispatcher can talk to a plane in his sector over radio communications channels through the switching unit and the line radio communications set through assigned channels; connect to standby channels; listen to conversations between dispatchers and planes in adjacent sectors, as well as switch over a radio communications channel for the plane to the control panel of adjacent dispatchers. The dispatcher can talk over telephone communications channels through the switching unit and line telephone communications set to subscribers of loudspeaker networks, channel switching centers, automatic dispatcher communications stations, other AS UVD centers and automatic long distance telephone communications.

The central control installation is a two-machine standby complex with a common trunk to which are connected coupling devices and input-output devices. The central control installation implements the adopted regulations for servicing subscribers; sets up connections between the dispatcher and planes and subscribers of ground communications networks taking into account their priorities for which the necessary software was provided. "Elektronika-60" computers with proper software are used in the central control installation.

Various types of operational communications control panels are used extensively in civil aviation. They consist of operator control panels and switching units that can be combined in one device or used separately. When used separately the operator panel is located at the work position of the dispatcher while the switching unit may be installed in a room convenient for servicing.

The introduction of UVD automatic systems led to the concentration of dispatcher posts and control panels for operational communications. Up to several tens of operational communications panels may be placed at the AS UVD centers. In this connection it became expedient to combine switching units and design a single switching device using modern principles of digital switching and time sharing. There are principles for designing such control panels and some types are already in use. One such version of designing operational communications programed control panels using the above considered approach is shown in Fig. 9.

The access systems consist of a main trunk and interfaces to connect the central processor and dispatcher subscriber sets. "Elektronika-60" series-produced microcomputers may be used as central processors in operational communications control panels. The central processor provides time switching of subscriber lines and additional services to subscribers like those in automatic dispatcher communications stations.

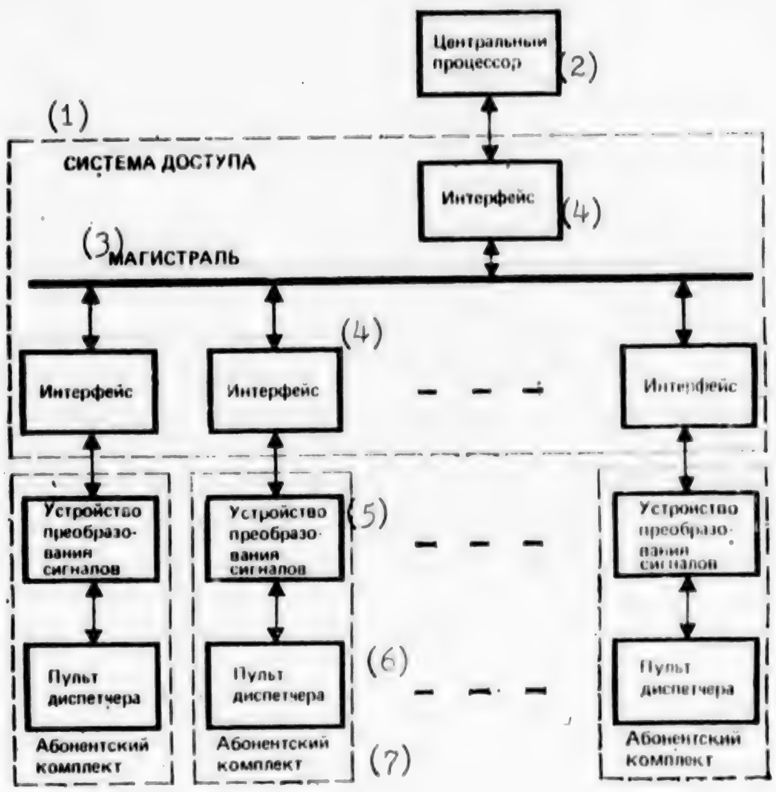

Fig. 9. 1 -- Access system; 2 -- Central processor; 3 -- Main trunk; 4 -- Interface; 5 -- Signal conversion device; 6 -- Dispatcher control panel; 7 -- Subscriber set.

Subscriber components consist of devices for signal conversion and dispatcher control panels. The devices for signal conversion are analog-digital and digital-analog converters. In digital communications systems they are designed on the basis of coders and decoders of pulse-coded or delta-modulated signals. The basic type of modulation in digital systems is pulse-coded modulation of signal modulation, but it is somewhat more complicated to implement than delta-modulation. In independent communications systems with limited external output, delta modulation of signals is the one most used. Therefore, UPS subscriber sets are coders and decoders of signals with delta modulation. Structurally they can be located with microcomputers or with dispatcher control panels.

Subscriber control panels have keyboards for calling subscribers which may be planes, dispatchers of adjacent dispatcher posts and other services that control flights.

Programed controlled panels for operational communications with time switching of subscriber lines and delta modulation of signals will be used in the very near future at AS UVD centers and other Aeroflot services.

The introduction of advanced digital transmission systems and integrated digital communications networks will make it possible to increase the quality and efficiency of data transmission in aviation communications channels. This, in its turn, will lead to an increase in the transit capacity of aerial routes, as well as to increased safety and regularity of flights.

Thus, systems of aviation communications, in their functions and scientific engineering standards facilitate the conversion of civil aviation into a comfortable, regular and safe form of transportation in our country.

RR TRANSPORT COMMUNICATIONS SYSTEMS

[By Viktor Valer'yanovich Grigorin-Ryabov, doctor of technical sciences, professor. Published over 70 papers on transportation communications systems]

The general special feature of communications systems of all transportation facilities is that they are implemented with moving objects. This limits the selection of a suitable means for such communications to only wireless means that use electromagnetic fields to carry data, i.e., radio communications systems.

Radio communications are used very widely in RR transport. They are used to control technological processes, to increase safe train movements and increase the transit capacity of the roads.

The use of radio communications in RR transport came late as compared to other sectors of the national economy. The first radio stations in our country came into use in 1948. Their basic purpose was to increase the productivity of switching in classification yards. A year later a so-called train radio communications began to be used for communications between the dispatcher or station masters and locomotive engineers on trains. Radio communications are also used widely for repair subdivisions.

According to GOST for organizing the lowest level of national economic radio communications, RRs were assigned the hectometer, meter and decimeter wave ranges. As a rule, two-way radio-telephone communications are used.

We will dwell in somewhat greater detail on special features of designing various RR radio communications.

Station radio communications. Radio telephone communications are used at stations between controllers (switching dispatcher, station master or operator) and the classification yard and engineers in switching engines.

The frequency meter wave range (151 to 156 megaHz) is used for these communications. They are organized by station locomotives and portable radio stations. Type ZhR-V-SS are used as stationary ones. Type ZhR-V-LS radio stations are installed on locomotives. All type ZhR-V radio stations provide communications on one of three channels with a spread of 50 kHz between them.

Office operators, train and car inspectors and armed security guards are equipped with portable "Sirena" and "Tyul'pan" radio stations. These radio stations operate in the 140 to 174 megaHz range and have only one channel, with a frequency spread of 50 kHz.

Station radio communications are designed on the principle of communications between a command post and moving objects. All stations operate at one frequency and form one radio communications circle. At large RR centers which have several switching areas, radio communications circles are created in each one of them with the operating frequencies selected in an assigned range to eliminate mutual interference.

Fig. 10 shows a simplified diagram of the organization of radio communications in a RR station which includes arrival yards (PP), classification yards (PF) and departure yards (P).

The operator on duty in the classification yard (DSPG) has a stationary SR radio station for communicating with the classification yard switching locomotive LRI (on frequency f_1). The operator can use the same radio station for the arrival yard (DSPP) from his post.

The switching work is directed by the attendant on duty at the departure yard (DSPF). He has his own stationary radio station SR, operating on frequency f_2 to communicate with switching locomotives of the functioning and departure yards. These locomotives are controlled directly by train make-up workers who carry portable radio stations operating at the same f_2 frequency.

The departure yard operator on duty (DSPO) can also use the DSPF radio station from his post.

The third switching radio communications network (at frequency f_3) is formed by the attendant on duty at the station SR and radio stations on the locomotives.

Inspectors and security guards on the territory of the station have their own communications network with the office (OTK), equipment inspection post (PTO) and the security post.

Train radio communications. This type of radio communications allows conversations between train dispatchers (DNTs) and station attendants on duty (DSP) with locomotive engineers and engineers of nearby trains with each other within a dispatcher section.

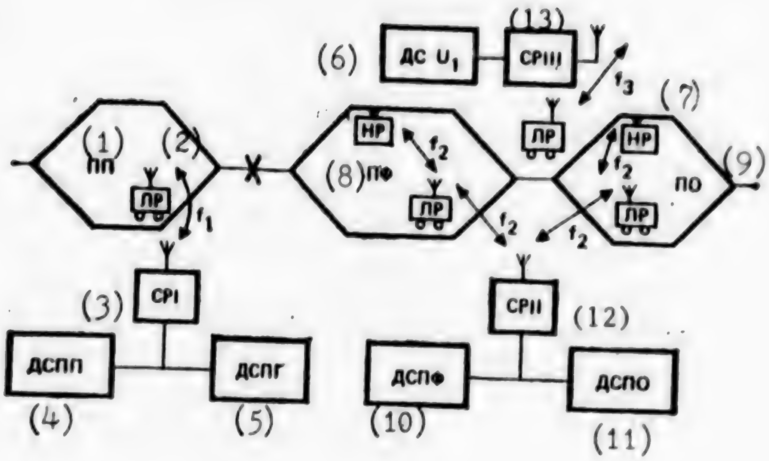

Fig. 10. 1 -- PP; 2 -- LR; 3 -- SRI; 4 -- DSPP; 5 -- DSPG; 6 -- DS-U; 7 -- NR; 8 -- PF; 9 -- PO; 10 -- DSPF; 11 -- DSPO; 12 -- SRII; 13 -- SRIII

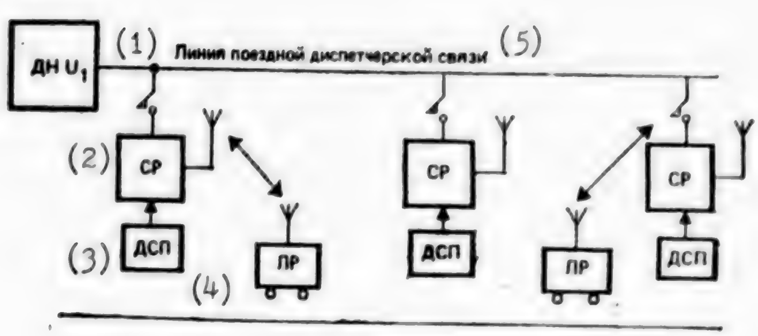

Fig. 1. 1 -- DNU_1; 2 -- SR; 3 -- DSP; 4 -- LR; 5 -- Train dispatcher communications line.

Train radio communications are organized on the linear principle. Stationary radio stations (SR) located at RR stations are connected to each other and to a controlling station dispatcher (RCh) by wire and radio communications lines (Fig. 11).

The dispatcher uses these lines to connect by remote control a stationary radio station nearest the locomotive with whose engineer he must establish communications. Since the communications beween the dispatcher and locomotive engineer (and vice versa) are implemented by radio and wire channels it is called radio-wire communications. At present it uses type ZhR-3 and ZhR-M radio stations in the hectometer wave range and type ZhR-VK-M in the meter range and operates on the simplex principle.

The high level of industrial noise, especially on electrified RR sections, reduces greatly the quality of data transmission over train radio communications channels. The highest level of noise is found on an electrified RR section with 25 kvolt AC when operating in the hectometer wave range. Therefore, with such noise it is necessary to run a guide wire along the RR track connected to the radio receiver of the stationary radio station. Sometimes telephone communications are used instead of wire.

Continuous radio communications with trains is still more difficult in tunnels. In this case, it is also necessary to run guide wires in the tunnels that are connected to receiving antennas at the entrance to the tunnel. If the tunnel is very long it may be necessary to install an amplifier-retransmitter.

In our country at present only the locomotive engineer can communicate with the dispatcher and the attendant on duty at the stations. The train conductor cannot inform the station of empty seats on the train, call for urgent medical help or about some other service problem.

This shortcoming will be eliminated in the new train communications system being developed. The train conductor will get his own communications channel to the nearest stations and through them also to the dispatcher.

The new system will make direct communications possible between the dispatcher and the engineer of any locomotive within his dispatcher range. A radial radio communications system operating on the duplex principle, without wires, will be used.

Besides voice information, discrete information which requires immediate implementation of the dispatcher's instructions by the train engineer will be transmitted.

In a number of foreign countries a so-called radiating coaxial cable or waveguide is run along the RR track. For this purpose the open-weave braid is used while there are slits in the waveguide along its entire length.

The use of these high-frequency devices makes it possible to have very reliable communications with moving trains and transmit a huge volume of data. It is possible to transmit TV programs to the train, and passengers can speak by phone to any subscriber in the country (and, in some cases, in foreign countries also).

A single radio communications system being developed at present and named "Transport," will provide not only communications with stations and trains, but also with train conductors, RR ticket offices and repair and operational services. It will be possible to direct repair work on the line and at stations and these services will be able to exchange information with locomotive engineers.

Recently news was received that tests were being made in Japan on using satellite communications to eliminate a dangerous situation on the Tokyo-Osaka RR line. The good results suggest the thought of using satellite communications not only in emergency situations, but also for regular train control.

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